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THE ART OF OLD JAPAN.
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·VOL· XXIV Nº 11

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Vol. XXIV. No. 11. MAY, 1904. Price 6d.

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EDUCATION IN PARLIAMENT.

THE SCOTTISH BILL AND THE ENGLISH ACT.

"*FAS est ab hoste doceri.*" The proverb is at least as old as Ovid, yet still the wise man learns from his enemies, who are a mirror to him of his former faults.

Mr. Graham Murray is a wise man. He has climbed by wisdom more than by brilliancy, and he has learned from the enemies of the English Education Act how to draft the Scottish Education Bill.

The First Reading of an Education Bill for Scotland is an event, and most of the Scots in the House of Commons were present. The English members were few, and the Irish fewer, but they included Sir William Anson, Sir John Gorst, Mr. Swift MacNeil, Dr. Macnamara, and Mr. Yoxall. The proceedings began with a pellucid exposition and a delightful piece of grave-faced comedy. Mr. Graham Murray introduced the Bill as though it was quite a little one. He took it by its tiny hand and encouraged it to toddle up the floor, so to speak; he invited it to babble babyishly and articulate "Da-da." The whole House beamed at the infant, and watched its tiny steps with avuncular good-will.

Then suddenly the infant swelled, grew tall in a minute, became a monster Boy of Peckham, though Banbury of that ilk was not present to admire; and the next thing was that everybody could perceive that this was really a big Bill—quite a William—of manly dimensions and adult mien. It was then too late to frown, and the House continued to smile. Such is the art and cunning of Graham Murray, lawyer, and master mariner in dangerous seas.

"*Fas est ab hoste doceri.*" In those seas the Voluntary School is a rock, or perhaps a quicksand; that much the English Act has shown. So Pilot Murray steered his bark around the Voluntary School, not upon it. Yet he could not leave it out of his course. He is a minister in a Conservative Cabinet, on which the Episcopal Churches have their claims, and a touch at the port of the Voluntary School was included in his charter-party and sailing orders, of course. But he is careful not to make it his chief port of call, as the enemy from whom he learns declares that Mr. Balfour did two years ago.

Assuming the character of a military strategist, General Graham Murray "masks" the Voluntary School. He draws the lines of his plan around it and beyond it; he isolates it, and leaves it to wave a flag of truce to the victorious School Board at its will. He does not assail the Voluntary School as a bigoted blot on a Presbyterian land and system; he does not try to blow it up, but neither does he clasp it to his bosom as the immediate jewel of his soul. The enemy says that Mr. Balfour did so; but General Graham Murray is not a Buller to waste his force upon a frontal attack. As a private person of judgment, and a brither Scot with Mr. James Caldwell, he does not love the Voluntary School overmuch; and he does not attempt to make the Local Authority love it, as Mr. Balfour did. "Please yourselves," he says, *dégagé*, to the canny bailies of the big School Boards that are to be; "help 'em with rate-money if you like, on what terms you like. And if they don't like, why—"

"If you can come to a decent arrangement with these fanatical schools, well and good," he intimates, in that nod which is said to be as good as a wink. "If they won't agree with you, so much the worse for them. But—between men of the world, now—men who don't take too much stock in the squabbles of mere theology—as man to man, now—don't you think you might possibly rig up a decent mutual arrangement with the Voluntary Schools?"

The Scottish members appeared to think they rather could, and the English members murmured, "*O si sic Anglia!*"

It is natural, somehow, to drop into Latin when Scottish education is engaging the ears and voices of the House; but Mr. Graham Murray kept to English—or, rather, to that fine old northern language which used to be called "Court Scots." He did not even mention *aut vitam aut culpam*, though he spoke of the Old Parochial, and repudiated any demarcation in educational grades. It appears that Scottish schools have been in some danger of getting Cockertonised. Mr. Balfour's way in England was not to render lawful what Cockerton had declared illegal. Mr. Graham Murray's way in Scotland is to bottle up the Cockerton imp with a special clause in his Bill. A wonderful hand at learning from his enemies is Graham Murray, the popular and bland.

He went from triumph to triumph, through a fusillade of cheers; and, wonderful to state, the cheers came from the Opposition mostly. The men who sat behind Mr. Graham Murray did not cheer much—they did not understand the matter. If it had only been more a question of Voluntary Schools, they would have understood. "One authority for all kinds of education in the locality," said the minister. Mr. Yoxall cheered; he saw his unifying idea triumph again. "Election *ad hoc*," said the minister, for once dropping into what is supposed to be the tongue of the Romans. And Dr. Macnamara cheered; he saw his idea, dead in England, lift its head in Scotland still. "The district of a county for area," said the minister. And Sir Henry Campbell-Bannerman cheered, though he showed some fondness still for the parish, on which he is never likely to come.

Then Mr. Graham Murray sat down, having made the whole matter as plain to the House and the Press Gallery as though he had brought into the Chamber a blackboard and chalk. Then the chorus of gratulation began. "*O si sic Anglia!*" was heard. "If you'll give us this Bill for Wales, we will stop defying mandamuses," said Mr. Lloyd-George—he did not Latinise the plural word. "I'm willing," he said, "to become a Scotsman *ad hoc!*" and the House had a vision of the big-eyed, square-browed little Fluellen leading to battle in a kilt!

Upshot: the Bill is safe, though the Provincial Councils part of it will probably be dropped after the Second Reading.

There was a Vote on Account—on account of the national expenses in 1904–5—and one of the items in it was a little sum of fifteen millions or so for education. So the House of Commons discussed the item from 3.15 in the afternoon till 7.30, and from nine to midnight—that is to say, the House was supposed to be discussing the Vote on Account: what was really under the fire of criticism was the English Education Act. And herein the illogicality of the English was displayed. Not a word was said about the fifteen millions, hardly; not a word was said, or hardly a word, about the administration of the Act. The House gave itself up to a Second Reading Debate on an Act of which the Second Reading was nearly two years bygone.

Observe the preposterousness. Here was an Act of which the first complete year's operations might have come under detailed consideration; but what the members did was to reconsider the bases of the Act, as though they were talking about a Bill. From the point of view of Parliamentary procedure this was an enormity. Not a man who spoke but was grossly out of order; but the Chairman of Committees (wise man!) never gave the least tug at the reins. The Debate got its head to its heart's content, and the administration of the Act went undiscussed.

Sir William Anson had got a perfect armful of a portfolio with him, crammed to plethora with Minutes, Orders in Council, Model Schemes, Draft Orders, typical correspondence, tests, statistics, and what not. The portfolio lay idle. Here was an Act under which a hundred precedents had been created: the precedents went almost undiscussed. The abortive compromises between clergy and councillors, Churchmen and Free Churchmen, in Wales; the need for a compromise; the need for public control undiluted; the need for catechetical teaching; the need for everything and anything except more education, better education, more teachers, better teachers, better attendance at school, longer years at school, condition of primary and secondary schools—were talked about. It was a perfect riot of bad logic, and eloquence, and amusement; it was splendid, it was magnificent, but it was not Education.

Not a word was said about the need for more Training Colleges; but that particular topic got two hours to itself—from ten till midnight—on another occasion. Mr. Henry Hobhouse moved that new Training Colleges were needed, and the State ought to pay for them; Dr. Macnamara moved an amendment that the State ought to pay for them in part. Sir William Anson accepted the amendment. There was no division, and the House, that had already gone to sleep, went off to bed.

A day before that Mr. Hobhouse had put a categorical poser to Sir William Anson in the shape of a written question, and that morning Sir William Anson had retorted in the shape of a printed reply. "What was the number of the candidates for the King's Scholarship Examination who passed in the First and Second Class at the two last examinations?" asked Mr. Hobhouse; "and what proportion of these candidates can be accommodated in the existing Training Colleges?"

"I'll tell you," said little Sir William, and took up three parts of a foolscap page of official blue paper with his printed reply.

As these are the latest figures on the point available, let them be quoted. At Christmas 1902, 521 men and 1,577 women passed First Class—total, 2,098; 933 men and 2,959 women passed Second Class—total, 3,892: grand total, 5,987, according to the paper, which nobody seems to have added up for themselves—*real* grand total, 5,990. Of these, 1,001 men and 1,872 women were admitted to Training Colleges so that 3,117 were shut outside.

At Christmas 1903 the First-Class men were 550, the women 1,904; the Second-Class men 1,016, the women 3,432. Total qualified by examination to enter a Training College, 6,902. Number of places available for them about 3,400. Result, half the King's Scholars shut out of a college.

Meantime the County and Burgh Councillors rage

BRITISH MUSEUM

together, and imagine a vain thing. Teachers are so absurdly scarce, they proclaim; we must really manufacture more teachers, they resolve: and the King's Scholarship Examiners prepare their tests and papers for a new batch of enthusiastic dupes.

It would almost seem that the House of Commons might better have discussed these figures for a day than the Bill of 1902, and the need for a compromise which would compromise everybody, and so will never occur. Let us stand in wonder before the contrast of the Scottish Bill and the English Act; but, after all, Bills and Acts are machinery—the teacher is the essential. In this play the teacher's the thing. And how are they going to get enough trained teachers?

BY MANY HANDS.

"Quot homines, tot sententiæ."

THE air is full of conferences and rumours of conferences, and seeing we stand at the threshold of a new epoch in education, there is small fear that the conference fever will abate very soon. For the Portsmouth "palaver" there is no lack of topics; indeed, everywhere the abundance is such that the most difficult operation will be that of selection and condensation. As soon as talking is over at Portsmouth, the municipal authorities in London intend to have a field-day, for they have caught the educational malady, and it sits heavy on them. Fervently we wish that out of these battles of discussion a clear, simple, and efficient policy may come—a wish that every Londoner must echo when he thinks of the almost daily conference going on in its new authority. As for its sitting with closed doors, about which many journalistic shrieks have been heard of late, we hope it will not emulate the description of a certain clergyman, who was said to be invisible on six days of the week, and incomprehensible on the seventh.

The Talking Assemblies.

THE results of an inquiry by a Viennese *savant*, Dr. Julius Zappert, on the liability of children to diseases of the respiratory organs, are not without interest and point. His observations lasted for three years, and cover in all 2,400 instances—a sufficiently broad basis for the deductions he makes. He finds that these diseases are at their maximum between the ages of six and eight years, diminishing (slowly during the first, and faster during the last two years) from eight to twelve years, but intensifying from twelve to fourteen. The doctor puts down the intensity of pulmonary troubles at the beginning of school life to the difference between the temperature of a classroom and that outside; to the dust created in schools; to being abroad in the streets in all weathers; and lastly, to the excessively early hour of opening school. This latter must be a peculiarly Viennese reason.

A Medical Inquiry—

THE last fact, that of the recrudescence of pulmonary trouble just at the time when the majority of children are preparing to quit school life, is of pretty serious import. It means everything for the future stamina of the race, and indicates clearly that stringent measures will have to be taken by educational authorities in the matter of competent and *constant* medical supervision of schools. The inquiry was Austrian; the results can be utilised by every country. Commissions on national physical degeneracy won't be of much use if such health curves as those of Dr. Zappert are neglected. It has often struck us as somewhat farcical that any moderately well-conducted boarding or secondary school of 150 children should receive its daily medical inspection, while primary schools of 1,000 or 1,200 souls should receive a perfunctory visit at sometimes extraordinary intervals. It is to be hoped that the new era will see new practices. But mark how the field of the educational responsibility of society is enlarging; for society is rapidly assuming a socialistic air, acknowledging the claim of the future citizen to mental, moral, and physical training at its hands.

—and its Moral.

THE sentiment of nationality sometimes runs a little mad. Such a case the action of the National German Union of the United States seems to us to be. They are raising a fund to found and extend schools of purely German education in the States. These are to be entirely unsectarian, because the private sectarian schools founded in the last century have failed. Those which were Catholic were drawn under the influence of the high Catholic American clergy (largely of Irish extraction), while the Protestant schools were drawn into the Anglican current. But is not this a confession, in advance, of the futility of the present action of the Union? They admit, up to the hilt, the influence of American surroundings—that influence of which the Americans make a great boast, and rightly. It is claimed that whatever may be the nationality of an immigrant, be he Dane or Pole, Englishman or Italian, Irishman or Russian, so powerful are the social, linguistic, and climatic influences by which he is surrounded, his children are indistinguishable from native-born Americans. How then can the Union hope to perpetuate a purely German national sentiment in the midst of such transforming elements? Taine's theory of *l'influence du milieu* in forming character never had a more striking proof than is furnished by the United States. "The stars in their courses fought against Sisera," and in the National German Union we see a twentieth century Sisera.

A Foregone Conclusion.

WHICH is the better—personal initiative in the matter of teaching, or an authoritative uniformity? This is no conundrum, but a serious question—so serious that for more than thirty years English teachers have fought for the personal initiative. The New Yorkers think differently, for the new plan of studies for their schools admits of little free play of initiative. Elbow-room, so to speak, is at a premium in New

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York schools. Seven booklets form the daily guide and mentor of their pedagogues. A general scheme of work, such as we know, is laid down in the first. Then follow minutely-detailed syllabuses of mathematics for the sixteen classes of New York school existence, followed by the same elaboration in drawing, manual work, sewing, cooking, music, kindergarten, physical training, elementary science, geography, geometry, morals, history, civil law, and English. We shudder. How one must fret, held in by such manifold leading-strings. And so bent are the authorities on entire uniformity, that every one of the 1,500 working *minutes* per week has its employment rigorously indicated. There is a sardonic touch in that *1,500 minutes*. There is no escape. "The programme, the whole programme, nothing but the programme," is evidently the motto of the New York Superintendent.

INTO the arena in which the fight about Education is being waged all sorts of champions have descended. Not the least notable among them is the Oxford professor Dr. Sanday, whose contribution takes the form of a pamphlet called "Justice in Education," in which he states the case for the Church as against the scheme put forth by the Free Churches Council, against Dr. Fairbairn, and even against the scheme known as "the Durham Concordat" put forth by the County Council for Durham. One thing all readers of the pamphlet must recognise—the deep earnestness of Dr. Sanday, and his evident longing to find some means of settling equitably the differences that at present divide Nonconformists and Anglicans on the question of the recent Acts of Parliament. He writes, as he says, under a strong impulse, a call, and with the purpose of conciliating. In the same spirit his work will be received.

Justice in Education.

HE states the case for denominationalism; traces the opposite idea to a political expedient of the statesmen of 1870; and after an appeal to both Churchmen and Nonconformists to make a clean sweep of their personal prejudices, and approach the problem with a desire for complete equity, he traverses the Education Act of 1902, and the causes for the resistance it has provoked. The Act he speaks of as a "compact," in which the State takes charge of the secular teaching in denominational schools, while preserving their denominational character; and he contends that the Church has in the compact bought the right to the preservation of this character by the buildings which she brings in as her share of the bargain. For this reason, and for the reason that the religious side of the question has deeper roots than the purely educational one, the Church will not yield her claim to the appointment of the teachers nor to the superior voice in management. For this reason he demurs to the Durham proposals as inadequate. His arguments have the ring of sincerity, and deserve to be carefully read; but we think he gives away the real point at issue when he acknowledges that the "compact" is illogical, but dismisses this illogicality as being thoroughly English. In things of this kind, to be illogical is to be unjust, and Dr. Sanday's plea for justice to the Church should make him see the force of this point in its relation to the effects of the Act of 1902. But our readers will do well to consult Dr. Sanday's booklet for themselves.

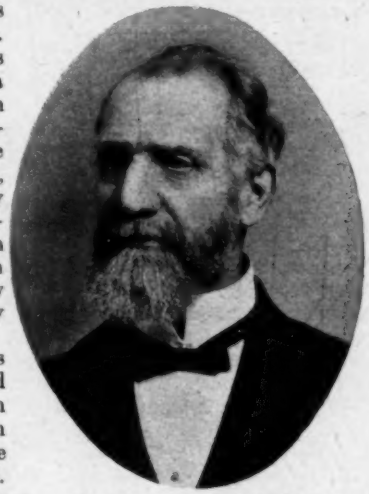
Dr. Sanday's Plea.

NOTES FROM THE NORTH.

THE last day for the nomination of candidates for the Presidentship of the Institute is the 30th of April, and the voting takes place during May. It may be of interest to members of the Institute and to others if we give a short account of the candidates who are seeking the suffrages of the Institute. There are three candidates—one hailing from the north-east, one from the east, and one from the west. There are also three candidates for the Vice-Presidentship, and great interest is this year being taken in both contests.

The Presidentship of the Institute.

Mr. John Forbes, F.E.I.S., headmaster, Springfield Public School, Cupar-Fife, who is the nominee of the Fifeshire branch, is a native of Dundee. On completing his apprenticeship as a pupil teacher in that town, he entered Moray House Training College, Edinburgh. In May 1864 he was appointed teacher in Springfield, which position he has now occupied for nearly forty years.

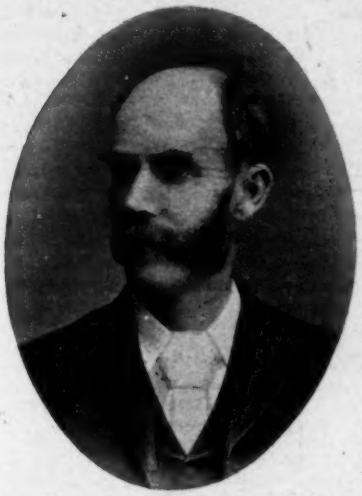


MR. JOHN FORBES, F.E.I.S.

Mr. Forbes has taken an active and prominent part in the Institute. In 1867 he received the degree of F.E.I.S. He has acted as President and as Secretary of the Cupar Local Association. In 1887 he was elected one of the Vice-Presidents of the Institute. Largely through his instrumentality, an amalgamation of the Cupar, Kirkcaldy, East of Fife, and Dunfermline branches was effected in 1894, and for a time he acted as its secretary. Mr. Forbes has served on the General Committee for twelve years, and on the Special and Finance Committees he has been of great assistance. In 1902 he was selected to represent the Educational Institute at the Irish National Teachers' Congress at Cork. In public affairs Mr. Forbes has also taken a prominent part. From the outset of the Cupar Parish Council he has been a member. His well-known capacity for public business led to his being elected Chairman of the Landward Committee. His business training, sound judgment, and force of character eminently qualify him for the post of President. His knowledge of all educational questions is wide and varied, and his enthusiasm for the Institute and the profession is too well known to be referred to here at this time.

Mr. John M'Kenzie, F.E.I.S., headmaster, Ashley Road Public School, Aberdeen, who is nominated by the Aberdeen branch, is a native of Banffshire. He entered the service of the Aberdeen Board as an assistant master, and is now the headmaster of one of the best schools under that Board. For twenty-six years he has been a prominent member of the Aberdeen Local Association, and has held the offices of secretary and president. During all these years he has been almost continuously a member of Committee.

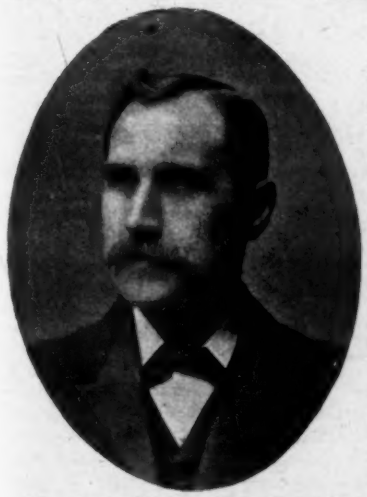
For several years Mr. M'Kenzie has been a member of the General Committee of the Institute, and has served on the Benevolent, Organisation, and *Educational News* Committees.



MR. JOHN M'KENZIE, F.E.I.S.

Mr. M'Kenzie represented the Institute at the N.U.T. Conference at York in 1900, the Public Health Conference, and the Class Teachers' Congress at Aberdeen. For three years he was one of the Vice-Presidents of the Institute. He was selected by the Aberdeen School Board to give evidence before the Royal Commission on Physical Training. His broad and liberal views on educational questions, his experience and energy, make him well qualified for the Presidentship.

Mr. James Young, M.A., F.E.I.S., rector of High School, Biggar, is one of the young men of the Institute. He was trained as a pupil teacher at Lanark Grammar School. On completing his apprenticeship, he entered the Glasgow E.C. Training College and University, where he graduated in 1888. For three years he was second master of Copeland Road School, Govan. He has always taken a deep interest in the welfare of the Institute. Since 1895 he has been a member of the General Committee, and has also acted on the Special, Rural Teachers', and Education Committees. For some time he was President of the Lanark Local Association. He represented the Institute at the Irish Teachers' Conference at Limerick in 1899.



MR. JAMES YOUNG, M.A., F.E.I.S.

Mr. Young has a most facile pen, and has contributed numerous articles to the press on educational and other topics. His leisure time is given up to angling, and I have frequently met him by the riverside, when education for the nonce was laid aside, and the "gentle art of angling" engrossed our conversation. Mr. Young's broad sympathy, his sanity, and his conspicuous clearness of view and fairness of debate have all combined to give him a foremost place in the counsels of teachers.

Whoever of these three is elected, I have every confidence that the lofty traditions of the Institute will be well maintained.

THE long-protracted suspense is now over, and perhaps we are none the worse for the delay which prevented the earlier appearance of the Bill. At all events, ample time and opportunity have been given to all interested in education to put their views before the proper quarters. Lord Balfour, by his invitation to educationists to discuss the subject of the present position of educational matters in Scotland, has made the task of the Government much lighter, and enabled them to find more easily the line of least resistance. The teachers, we are told in some quarters, will be exultant. The Bill is indeed a strong one, in so far as it is an effort to work along established lines, and to carry out to completion a system which has approved itself to the people of Scotland. It is evolutionary, and as such is likely to meet with pretty general acceptance. It is drawn on generous lines, and is very much in accord with the oft-reiterated desires of the Institute. In some of its details, as I shall have occasion to show, there is room for a difference of opinion; but in the main features it will be readily conceded by the profession that the Bill shows the mark of a master-hand, and of a no less proficient apprentice.

The Scottish Education Bill.

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THE doom of the small School Boards is sounded. What was needed was a comprehensive survey of the educational needs of every district, the provision of educational facilities suitable to every locality, the avoidance of wasteful and very often harmful overlapping, and that one authority should control in each district all the different grades of education—in a word, co-ordination and consolidation. One of the points on which the Institute insisted was that education would be more living if its administrators derived their power directly from the people. Many patriotic men will be found able and willing to give their time and energy to the work of education who have neither the time nor the inclination for roads, sanitation, and the thousand and one other matters for which County Councils are principally and primarily constituted. The cumulative voting goes by the board, and women are eligible for election to the new School Board.

Ad hoc.

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THE new unit of administrative area is to be the County Council district, or, in the case of small counties, the whole county. At present there are 973 School Boards in Scotland, and according to the Bill there will be 111. Of these four will be City Boards—Edinburgh, Glasgow, Aberdeen, and Dundee; and eight will be County Boards—Caithness, Clackmannan, Elgin, Kinross, Nairn, Peebles, Selkirk, and Sutherland; the others will be District Boards. In the interests of education, the extension of the area had become an absolute necessity. The present shortage in the supply of teachers is in a large measure due to the "cribb'd and confined" area of the present School Boards. Mr. Graham Murray, in introducing the Bill, said, with reference to this subject: "The question of improving the teacher is at the bottom of the question of education, and anything we can do to improve the condition of the teacher is all for good, provided only that we do not make our teachers our masters instead of our servants. One of the great difficulties of the past system has been not altogether the question of money, but that with the

Extended Areas.

small School Boards the county teacher has no career. One great advantage which I hope will flow from this scheme is that, the educational area being larger, there will be a chance of a teacher being moved round within that educational area. A man will no longer feel that if he goes to a small country school he will bury himself, but that he will have from his own educational authority certain chances of promotion. It will also to a certain extent get rid of the occasional—they were only occasional—but sometimes very real capricious dismissal of the teacher by a very small body."

TO maintain local interest, each school will have local managers—to the extent of one-third appointed by the educational body, and two-thirds appointed by the Parish Council (except in the cities). I venture to think this is the weakest part of the Bill. The Government has chosen the District area presumably on the grounds that it is not too large or too small. If it is not too large, why have they sought to introduce the Parish Councils into the management? It tends to weaken the principle of wider areas. Wherever there is a separation of "management" and "control" there is bound to be friction. Then, again, the Parish Councils are not elected for the purpose of education. They have no educational traditions. It is true that they have no power to dismiss teachers or to borrow money. I trust the Government will introduce some new method of dealing with the schools. The special committee of the Institute strongly objects to this part of the Bill. It favours sub-committees of the Board itself, plus a co-opted minority. In introducing the Bill the Secretary for Scotland had reserved also the power of appointing teachers to the School Board itself; in the Bill, the words "of appointing" are left out. Only by appointments being kept in the hands of School Boards, it is maintained, can a right system of promotion be properly carried out. It is to be hoped "first thoughts" will here be taken.

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IT shall be lawful for a School Board, if they think fit, to incur expenditure, and to defray the same out of the school funds, in paying pensions or retiring allowances to teachers in their employment who were certificated teachers before the commencement of the Elementary School Teachers (Superannuation) Act, 1898, irrespective of whether such teachers have accepted the said Act or not, and anything in the said Act to the contrary notwithstanding. I should like to have seen it made compulsory instead of optional. There can be little doubt that the miserable pittances now given will be supplemented by the more enlightened School Boards, but it is just possible that it will not be done where most necessity exists, especially where salaries all along have been *very* inadequate.

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IT is proposed to establish four Provincial Advisory Councils—one in Edinburgh, one in Glasgow, one in Aberdeen, and one in Inverness. I look very favourably on the establishment of these councils, though I should have preferred to see one National Board working through perhaps four committees. The constitution of the councils is at present very indefinite. The universities appear to be over-represented, while the Institute finds no mention in this section of the Bill. It is to be hoped that this will be remedied before the Bill becomes an Act. Among their duties should certainly be the training of teachers. This subject is not mentioned in the Bill. I trust, however, that facilities will be given to the universities to carry on the training of teachers.

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FOR the sake of convenience, I add here a brief summary of the leading provisions of the Bill:—

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TO report with any fullness the proceedings of the Portsmouth Conference is quite impossible with the limited space at my disposal. Besides, this has been already done by the weekly educational newspapers, with their staffs specially augmented for the occasion. My object will be rather to supplement what has already appeared, with a casual reflection here and there of my own.

SATURDAY, *2nd April.*

I journeyed to Portsmouth with the special Midland "N.U.T. Express," which carried about 100 delegates and their friends from Lancashire, 50 or 60 from Yorkshire, and a fair sprinkling from the Midlands. Admirable arrangements for every one's comfort had been made by Messrs. Priestley and T. G. West; and although the journey was long, the time passed pleasantly enough. The fine saloon and corridor carriages of which the train was composed enabled one to walk from end to end, and chat with one's friends and acquaintances. The passengers were variously engaged. Some few

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The day was brilliantly fine, and "The Front," especially that portion known as the Clarence Esplanade, was crowded with visitors. In the morning many delegates made their way towards Eastney, and by the kind permission of Colonel-Commandant W. Campbell, a hundred were admitted by ticket to the morning service at the "Crinoline" Church. In the afternoon a party of one hundred set out under the conductorship of Mr. G. Hore from the Town Hall at half-past two, and made their way through Victoria Park, where the monuments were inspected, past the naval barracks and Lion Gate, along the line of the old ramparts, past the Land Port to John Pounds's House, past the Camber, the Sally-port, King's Bastion, and Garrison Church to St. Thomas's Church, where the vicar (the Rev. R. S. Medlicott) gave a short history and description of the church. Several delegates went by car to Horndean, and hundreds walked on "The Front" in the evening. At Victoria Wesleyan Church reunion services were held for Westminster and Southlands Colleges, which are, as every teacher knows, respectively the men's and women's training colleges of the denomination. The preacher in the morning was the Rev. J. C. Stanfield, and in the evening the Rev. J. Dymond, superintendent.

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luncheon; and when the President rose just before three to deliver his address, the floor of the hall and the side galleries were crowded with an enthusiastic and attentive audience.

The President's Address.

A brief summary, outlining the main points of Mr. Sharples' admirable deliverance, can alone be furnished here.

"The educational year just closing marks the beginning of a new and, let us hope, distinctly progressive epoch in the history of national education. The Education Act of 1902 came into operation in April 1903. Up to that time the burden of national education had been most unequally distributed, and it was inevitable that, to be truly effective, the new Act must be of a somewhat revolutionary character. It proved to be revolutionary in its financial readjustments, and in the new character of its administration. It provides for the setting up of 333 Education Authorities, which cover the whole of England and Wales. It destroyed without remorse the great urban School Boards, which have done an unparalleled and a magnificent work (Cheers) in the uplifting of elementary education, equally with the small village School Board, which too often made its work a byword and reproach. It brings into line and into organic connection with the Local Authorities the 14,275 bodies of Voluntary Managers who conducted their schools without reference to any other school or public body, and places on the management of each school at least two representatives of the outside public. It lifts education, hitherto partly run by voluntary contributions, raised in 'divers,' and, it may be added, sometimes in 'devious' ways that degraded the object for which they were obtained, to a higher and more fitting plane,

THE PLANE OF NATIONAL AND LOCAL RESPONSIBILITY

for the well-being of the children. For the first time in the history of the country it makes the whole cost of public elementary education a public charge.

"It gives certain rights which have been long sought by the members of the Union—a form of appeal against unjust dismissal, the prohibition of compulsory extraneous tasks, and the civic right of the teacher to share in the duty of local control of public education. Two-thirds only of the country have hitherto been rated as well as taxed for the upkeep of the schools in their areas, and now the backward third must make up its lack of support in the past. In other words, the finance and administration of public elementary education have been placed on a national basis. It is now possible (with certain exceptions) to bring all grades of education—elementary, technical, and secondary—under one and the same local authority in each district. It is for this one solid foundation that the National Union of Teachers has welcomed the Education Act.

"The 'placing of all grades of public education under one authority' had been one of the main planks of the Union platform for many years. The Union believed, and still believes, that this is the only plan by which a coherent system of national education can be realised.

"The policy of the Union has been consistent, and its officers, executive, and officials in 1894 showed 'foresight, educational enthusiasm, and constructive statesmanship' in laying down the outlines of a great plan of national administration, which, in spite of many rival plans, and many attempted variations and attacks, is the one finally adopted, and which, in our judgment, is now the most solid foundation of the Education Acts of 1902–3. (Cheers.)

"THERE ARE, HOWEVER, TWO VITAL PROVISIONS OF THE ACT

—(1) The control *and management* of non-provided schools; (2) the continuance of 'denominational' religious instruction, which carries with it the appointment of the head teacher, with reference to religious creed and denomination—which have once more let loose 'the dogs of war' in religious strife. Upon (1) most moderate men have only one opinion, that all schools maintained by public money must be under public control *and management*; and if partly maintained, the control and management should bear a proportionate ratio to the cost contributed. (Loud cheers.) This is an irrefutable position in public taxation, and is bound to come. (Renewed cheers.) But it is upon (2) that the bitterest of all struggles, a sectarian struggle, is now being waged. Surely it is not beyond the wit of men—nay, of Christian men—to devise a scheme that shall save the schools from seeing the Bible banished. The religious difficulty has been conspicuously absent from the 'inside of the schools' from the very beginning, and this notwithstanding the fact that to thousands of teachers 'a theological limit' has barred promotion, in over 14,000 schools, to headships, and hitherto—but now removed—even to minor appointments. It must not be forgotten that there are 8,000 village schools, which are the only schools available for children of all denominations; further, that there are nearly 3,000,000 children in the provided schools receiving Biblical instruction free from 'Creeds;' and surely no one imagines that they all belong to one denomination—instruction which has been given by trained and skilled teachers with complete satisfaction to the authorities and the parents, or, at any rate, with such a decimal point of complaint that it is infinitesimal. The vast majority of the parents have 'trusted the teachers,' who, from their daily experience of the children and an intimate knowledge of 'child-mind' and its capacity, know *how* and *what* to teach the children, to enable them 'to try to walk uprightly,' to give them a love for 'the Book' that has been the staff, the comfort, and the guide of generations of our people, leaving the subtle interpretations for the later years, when their minds are more mature, and better fitted to seek spiritual insight and doctrinal interpretation from the ministry of their respective churches. (Loud cheers.)

"On the representatives of the Christian churches a tremendous responsibility lies. '*The handwriting on the wall*' may not yet have been interpreted, but one would point to the recent London County Council election and the position in Wales, a country that for strength and depth of religious feeling is not behind the rest of the United Kingdom. Let not the working classes of this country be driven to a 'counsel of despair.' If this unchristian strife is to continue with ever-increasing bitterness, men will be driven to the only logical conclusion, 'Secular instruction' alone. My own opinion is that such a result would be a national calamity. (Cheers.) I believe that the mass of the people are in favour of simple Biblical teaching in the schools, and I implore the leaders of our Christian churches *to come to some common agreement* for the sake of the children. Once the Bible is banished from the schools, it will soon become a rare book in the home.

"Meanwhile, the teachers have daily to fit the children for their life in the present. The future vitality of the nation depends upon the present education of the children. However controversial the Education Act may be so far as religious education is concerned, in secular instruction it is a charter of equal opportunity for every child. It may be said that, with the exception of Wales, the whole country is now actually mapped out into some 320 authorities having control over education within their respective areas. It is a gratifying fact that the new authorities have, in the main, shown considerable trust and confidence in the teaching profession, when it is noted that 592 teachers are either members of the authorities or on advisory committees. It may be safely asserted that, generally speaking, the Education Committees have taken up their work with a broad-minded desire to carry out the provisions of the Act in the best interests of the children and the nation."

A keen diagnoser of all educational requirements, Mr. Sharples was quite at home in dealing with

THE PROBLEMS BEFORE THE NEW AUTHORITIES.

"They are confronted immediately, after formation, with a *startling dearth of efficient teaching power*. In the great urban centres the services of certificated teachers cannot be obtained, for the simple reason that they do not exist. The children in the non-provided schools are compelled to wait until a supply of certificated teachers can be created. In the county council areas, where there has been no previous education authority to build upon, the state of things is worse."

After fortifying his opinion with statistics, and showing that of the 150,839 teachers in the schools on August 31, 1902, 116,927 were women and girls, Mr. Sharples asked:—

"What are the causes that have brought about such a deplorable dearth and such a great disparity between the sexes in the teaching profession?" In his opinion it was due to the hard and unattractive lot of the pupil teacher; his problematical entrance into a training college; the lack of promotion to headships; the hitherto miserable stipends of both head and class teachers; the huge classes; the closed door to the inspectorate; the prevention of promotion to secondary schools by confining all teachers from primary schools to Column B. of the register; and finally, the low value placed on the status of the teacher, especially in country districts.

"IT IS EVIDENT THAT THE SUPPLY AND TRAINING OF TEACHERS

is a prime and urgent necessity, and the Act of 1902 gives the new authorities power to begin to remedy this enormous shortage

in the supply of teachers. The county councils especially need to face the problems with a new and wider outlook. Their difficulties have been further enlarged, because, and not a moment too soon, the salaries of the certificated teachers in the large urban council schools have been increased as a body, whilst the greater number of the borough authorities, excepting a few—for example, Halifax—have felt that common justice demanded that the salaries, in non-provided schools, of the teachers who have so long and patiently borne the greater share of the 'intolerable strain,' should be placed on the same level as those of the teachers in the council schools. The question is so acute that one wonders at the want of business acumen shown by a few of the county authorities, who have framed scales of salaries under which they expect to secure head teachers for amounts in some cases considerably less in maximum than what are paid to class masters and mistresses in large towns. This policy will be disastrous to the staffing of the country schools. They have suffered keenly in the past, but in such counties they are likely to suffer still more. What have the children in the country villages done that they cannot have the same opportunity of being taught by properly qualified teachers as the town children? (Cheers.) Their future value to the state is as important, their physical and mental powers are as great, and their opportunities should, as nearly as possible, be equal. The financial side of the question cannot be ignored. It must be boldly faced, and those authorities show the greatest wisdom in making arrangements whereby candidates may be induced to enter the profession; and this can only be done by making the salaries of teachers worthy of their office, and sufficiently attractive to bring in a good supply of the 'raw material.'

"The local authorities are face to face with the possibility of all their available funds for secondary education being swallowed up by the necessity of establishing training institutions. If education is

A BRANCH OF THE NATIONAL SERVICE,

the training of teachers should be a national and not a local charge. Teachers should be trained not for the locality but for the nation. The County Councils Association have rightly approached the Board of Education for help. They should demand that at least 'the establishment charges' should be borne by the central exchequer. Since writing the above, the House of Commons has agreed that the greater part of the cost *should* be charged on the national exchequer."

Mr. Sharples next put in a powerful plea for the child of ability, but of humble parentage:—

"In the widening of the educational advantages to be enjoyed by future teachers, care must be taken that the children attending primary schools are not shut out from entering the profession, which is indebted to these schools for many of its most distinguished teachers. The only way this can be done is by establishing bursaries for deserving pupils from primary schools, so that they may not only receive education at the secondary schools, or preparatory classes to the pupil-teachers' centres in country districts, but that some little may go as 'maintenance' to the prospective teacher before he is eligible to be placed on the salary sheet of the school authority. Manchester has already considered the question of the training and supply of teachers, and has issued a valuable report, which may be useful as a guide to other authorities."

Mr. Sharples then gave an account of the Manchester bursary scheme for prospective pupil teachers.

"These suggested lines meet the new conditions, and keep in mind the value of the pupil-teacher system which, in the past, has prepared

A RACE OF SKILLED PRACTICAL TEACHERS.

Under wider opportunities of a liberal education, they will combine knowledge and mental breadth with the most skilled 'technique' in teaching. The scheme recognises that a liberal education is not all—the power of exposition and the art of control are equally essentials, if the teacher is to be effective in imparting his knowledge to his pupils.

"The provision of training colleges must necessarily follow from the establishment of pupil-teacher training institutions. It is estimated, roughly speaking, that in future, to keep an adequate supply of properly qualified certificated teachers for the primary schools, there should be over 5,000 trained teachers sent out to meet the demand under the new authorities. The Board of Education calculate that the annual supply from the colleges is 2,800 teachers, who have been trained for the normal period of two years. Yet at the King's Scholarship Examination in December 1903 there were 13,619 candidates—2,778 men and 11,841 women. Of these, 6,902 were placed in the first or second class, and were eligible for admission to a training college. As there were only 2,800 vacancies, it means that 4,102 successful scholarship winners cannot have the benefit of their scholarship, and, unless immediate provision is made, will go with the 4,871 candidates in the third division to swell the ranks of the ex-pupil teacher assistants. There is no other alternative—the Education Authorities will have to set up additional training institutions. The undertaking, however, is of so costly a character that it will be necessary for the county and county boroughs and other authorities to act in combination with each other. The claims of the small army of 36,265 ex-pupil teachers should not and have not been overlooked by several authorities in their schemes. Provision is proposed to be made whereby such present teachers shall partly teach, and partly study in special classes for their certificates. Until such times arrive as will make it possible for every member of the profession to go through the whole course of training outlined—secondary schools, pupil-teachers' colleges, training colleges, university or residential—justice demands at least that the best provision of classes possible should be made for them to obtain their certificates, and thus become properly qualified teachers. (Hear, hear.)

"The next step is

THE CO-ORDINATION OF THE SCHOOLS.

Hitherto, with over 16,000 bodies of management, no coherent system was possible, except in the large towns blessed with a progressive School Board; and even in these areas they could only deal with the primary schools, therefore there was no organic connection with other secondary schools. The only connection was by means of a few scholarships, totally inadequate in number and value. Hence there came about the 'evolution' of what have long been known as 'Higher-Grade Schools,' with schools of science attached, which, notwithstanding the continued attacks of enemies of popular education—and many of those in the educational world—are schools which alone, except in a few isolated cases, made possible 'the educational ladder from the common school to the university.' These schools in the great urban centres formed not merely 'an educational top' to the primary schools, but served as the only bridge to the technical schools, and in some notable instances, as Cardiff, Leeds, and Manchester, sent some of their pupils direct to the universities themselves."

Mr. Sharples then proceeded to give some very interesting details as to the academic success of scholars from the Leeds and Manchester Higher-Grade Schools.

"And yet these are three of the schools that would probably have been shut down under the ruling of that 'Meteoric Cockerton,' if it had not been for the Education Act. It is clear, then, that in any scheme of co-ordination these schools should form an important link. The basis should be the primary schools and the lower forms of secondary schools. The pity of it is that, when we are considering a national system of education,

OWING TO CLASS AND SOCIAL DISTINCTIONS

in this country, the basis cannot be on primary education in the common schools, where the children of all classes who take advantage of state or local aid could, side by side, receive the foundations of a sound education in English and in the lower branches of mathematics. Hence, before there can be a real linking-up of the primary schools to the grammar schools, for example, the curricula of the lower forms in the latter schools would require a radical change. This assumes that it is desired to 'garner' into the higher schools from the primary schools the boys and girls on whom Providence has bestowed superior brain power, and whose special gifts should be cultivated, not merely for the sake of the individual, but for the good of the nation. The records of the grammar schools of the country would prove that the 'aristocracy of intellect' is not confined to any one class of the community—that the boys from the primary schools are at least as capable, given the opportunity, of mounting the educational ladder and carrying off the highest university honours as their brethren of the grammar school.

"The primary school being the base, and the only school the great mass of the children will ever be able to attend, it will require a curriculum that will give a sound English education up to the age of fifteen years. The very best of the children—those of marked capacity, not those merely who have been crammed to pass a special examination—by a well-planned scheme of national and local scholarships should be passed on at about the age of twelve to a secondary school—the higher-grade school or the grammar school of the right type. The children who remain in the primary school, and whose parents, in spite of very limited means, keep them at school until fourteen or even

fifteen years of age, should have efficient teaching power, and the classes in size should more nearly approximate to those in the secondary school. The curriculum of these upper classes should be such as would develop the thinking power of the children, and at the same time give them a deeper and more permanent desire to go forward in quest of knowledge. In hundreds of villages it is not possible to link up the elementary schools with a good secondary school, and here the children generally leave at an earlier age. If they stay with the present limited supply of qualified staff, the children in the last two or three years of their school life have to be grouped in one class, and there is no stimulus for the children in going over partly the same work, and no inducement for the parent to keep his children at school. (Hear, hear.) The loss to the children in the aggregate must be enormous, and it is a loss which could largely be obviated by the placing at the top class of every school in the country an additional certificated teacher to take these children. This may be parochial, but it is a simple and effective way open to the poorest authority.

THE ORGANISATION OF THE SECONDARY SCHOOLS

will be the most difficult task of the authorities. The greatest difficulty will arise in bringing the curricula of the various types of schools into correlation. Yet it is essential when public aid is to be given to the schools. For a time, at least, it will be necessary to utilise the private schools now in existence, and after careful inquiry as to curricula and equipment, it may be necessary to subsidise them, subject to the usual safeguards as to representation on the management. None of this type should be aided, however, whose curricula do not form a link which will couple on to the technical school or university college. The differences of local needs will probably result in the formation of a new type of schools. It is impossible, therefore, to lay down anything but the broadest outlines; but the new authorities, so far as day instruction is concerned, can utilise the higher-grade secondary day schools, which are already in organic connection with the primary schools, and which are provided with staffs of trained and experienced teachers. The conversion of some of these into 'B' secondary schools, where no good local grammar school exists, will permit of a greater elasticity in the curricula, so as to enable it to satisfy the requirements of the district. The present rate of fees could not be disturbed if there is to be a free passage from the primary schools for the children of the working classes. The fees of the grammar schools, where no higher-grade schools exist, would act as an impassable barrier, except to scholarship holders, and no system of scholarships can be extensive enough to admit a fair proportion of children from the primary schools."

The necessity for good evening schools was next very properly urged:—

"In addition to the day secondary schools it will be necessary to form and organise good evening schools, such as many of our great cities possess, whereby the great mass of the children, who leave school at the early age of thirteen or fourteen, may be gathered in to continue their studies. These schools would act as feeders for the evening work of our technical schools, which, it is to be hoped, will become 'the universities of the people' in fact as well as in name.

"The number of pupils attending evening schools—527,729—is wretchedly small, and the question of compulsion between the ages of thirteen and sixteen, at least, is becoming urgently necessary. In every large area, then, the primary schools should send the great bulk of their children to the evening continuation schools, and from thence to the evening technical schools. The scholarship, and specially selected, children should pass at twelve years of age to the higher-grade secondary school or the grammar school, and from thence to the technical day school, which should be of university rank, or to the university college. If we are to have a body of leaders in the industrial occupations, leaders with inventive power to improve old and create new industries, there must be a much larger number of pupils prepared to take up the day courses at the technical schools."

By way of illustration Mr. Sharples showed that while the day attendance at Charlottenburg was 4,378, at the Manchester "Charlottenburg of the North" it only reached 242. It is striking to note that while in Manchester the number of boys in the secondary schools is only 2 per 1,000, in Berlin it is 10 per 1,000.

The closing words of the address fitly alluded to the attempt to reimpose individual examination upon teachers who are being trained on the lines of inspection.

INSPECTION *v.* EXAMINATION.

"We cannot under any circumstances return to the soul-depressing system of individual examination. (Loud cheers.) It meant rigidity, whilst the present system means elasticity. To return to the dark days of the past would mean a revolution of the curriculum, and an abandonment of modern methods of instruction—the killing of any taste for further study—the oppression of the children of slow but not necessarily poor intellect—the 'marking time' of the intelligent children—the robbing of light and love from the schools. No teacher worthy of the name neglects taking 'mental stock' of the children, and no inspector is worthy of his office who is unable to gauge the work of the schools by careful and intelligent inspection."

The termination of the address was marked by a great outburst of enthusiasm. It was admirably read, the President's impressive, sincere tones becoming almost solemnity itself at times. During the week I heard nothing but commendation of Mr. Sharples' fine effort. It was eminently characteristic of the man—statesman-like, sincere, tactful, yet straight, and with no pretensions to fine writing. Mr. Wardale voiced the thanks of Conference in a short speech, pointed with witty sallies, and Mr. Shawcross, one of the Union's "coming men," seconded in excellent style. Next came the announcement of the result of the

Election of Vice-President.

MR. TOM JOHN	16,855
Mr. Thomas P. Sykes	6,134
Mr. Fred C. Blackburn	5,211
Mr. Edwin R. Phillips	3,809
Mr. Frederick Peaker	(Retired)

Mr. John's success—foretold by the *Practical Teacher* months ago—was undoubtedly popular with the Conference, and as he rose ("the first Welshman from Wales to become Vice-President") he was very cordially received. The trifling persiflage with which he commenced his thanks soon gave place to better things; and I heartily endorse his own desire that he will maintain the dignity that is always associated with the presidency of our great Union. The defeated candidates, in response to loud calls from the delegates, rose in their turn, and each said a few words in excellent taste.

Mr. G. M. E. Hamilton was, for the twentieth time, re-elected Treasurer of the Union, without a contest, and well he deserves the distinction and the confidence thus placed in him. Mr. Hamilton struck a new note when he moved "that this Conference desires to express its sincere sympathy with the relatives and friends of the officers and men who lost their lives in the Submarine A1, and hereby authorises the Treasurer to make a donation of twenty-five guineas to the fund now being raised for the relatives." From every part of the hall came cries of, "Make it fifty." Mr. Hamilton said, in response, that he had made careful inquiries since he came to Portsmouth, and was confident that if they did what he had asked them to do, it would meet the necessity of the case. Mr. Sandford, a local Executive member, having seconded, the representatives all rose to their feet, and the motion was adopted in silence.

MONDAY EVENING.

One would need to be almost ubiquitous to attend all the functions fixed for this evening. The chief of these were the Class Teachers' Gathering, the Annual Meeting of the Teachers' Provident Society, the Annual Meeting of the National Federation of County Teachers, and the Mayor's Reception. The Class Teachers' Gathering was one of the largest and best I have ever seen in connection

with the N.U.T. Conference. Not only the class teacher members of Conference, but the foreign delegates and many leading lights of the Executive were present as guests at tea of the Portsmouth branch of the N.F.A.T. Every one seemed happy, and there was some brisk and pointed speaking. Mr. Yoxall, M.P., alluded to the good work already done by the Federation, expressed his deep sense of the assistance the organisation had been to the N.U.T., encouraged his hearers to go on from success to success, and assured them that "a wise man knew his own price." *Verb. sap.!* The thanks of the guests were fitly voiced by the Treasurer and the Secretary of the Federation, and then came two delightful replies from the President and the Secretary of the Portsmouth Class Teachers' Association. Other speeches followed, including one from Mr. Allen Croft, the only class teacher President of the Union, who warned his old friends and comrades against referring to the "honourable profession of class teachers," lest outsiders should consider it as something distinct from that of the head-teacher.

There was a large attendance of members at the annual meeting of that particularly valuable society, the Teachers' Provident Society. Mutual congratulations between the Board of Management and the members seemed to be the order of the evening, although a lengthy discussion took place regarding the amount received by the Board as fees during the past year. Eventually it was resolved that "in future the survey fees received by the members of the Board of Management be tabulated and embodied with the other financial statements."

The Mayor's Reception was perhaps the most brilliant function of the week, over two thousand representatives and friends being present at the Town Hall to enjoy the lavish hospitality of the Mayor and Mrs. Pink. The ladies' dresses lent gladness and gaiety to the bright scene, the music supplied by the artillery band was admirable, the refreshments provided so bountifully all that could be desired, and the opportunities for "talk"—so beloved by Dr. Johnson—endless. Despite the enormous number of guests, locomotion was always possible.

TUESDAY MORNING.

Punctually at ten o'clock the President rang his bell, and there was a hush of expectation as he proceeded to announce the results of the election of the Executive.

In the provinces all the old members seeking re-election were returned, but in South London two old members—Messrs. T. T. Burkett and W. A. Nicholls—lost their seats by narrow margins. Each of these gentlemen had done valuable work round the Executive Board, and it is one of the deficiencies of our present system of electoral districts that good men like these should be dropped, whilst comparative mediocrities in other districts should be triumphantly returned year after year—in some cases unopposed.

There are altogether six new members—namely, Miss Jobson, and Messrs. Cosnett, F. W. Goldstone, Holdaway, Rhys Nicholas, E. R. Phillips. Miss Jobson is the first class mistress to be elected on the Executive, and worthily has she earned the distinction, having been for many years an active and strenuous Union worker. Mr. Phillips returns to Russell Square after a year's absence. He is the type of Union leader who invariably does us infinite credit. Mr. Goldstone has won his spurs as an officer of the N.F.A.T., and is without a doubt a potential President of the Union. Mr. Holdaway has striven hard to put some backbone into the rurals—or ought I to say "county" teachers?—and with indifferent success. Messrs. Cosnett and Rhys Nicholas are well known in Liverpool and South Wales respectively, but their fame is only local as yet. Tuesday morning was mainly taken up with a discussion, inaugurated by Dr. Macnamara, M.P., on the vital question of scholarships, and he had the satisfaction of seeing all his proposals carried. These were so important and edifying that I am compelled to append them:—

"(1) That every local authority under the Education Act, 1902, be respectfully requested to prepare and publish for gratuitous circulation amongst the older scholars of the elementary schools a prospectus of all scholarships and exhibitions existing within its area, with full particulars respecting the same.

"(2) That every public elementary school should have attached to it a number of scholarships, such number to be proportionate to the number of scholars enrolled at the school. These exhibitions should be awarded on the nomination of the teachers and managers.

"(3) That the remainder of the scholarships available for the area should be awarded afterwards by competitive examination, in which *viva voce* testing should play an important part among scholars in various schools within that area in manner hereinafter provided.

"(4) The examination for scholarships should be of such a nature as to discourage preparation in a special scholarship class, as such form of preparation is to be deprecated both on account of its effect on the scholarship candidates themselves, and also on account of the injury inflicted on less intelligent children who are thereby deprived of the stimulus of the brighter intellects. The selection should be made by teachers and examiners in co-operation. The tests should be both written and oral.

"The examination should invariably be based upon the curriculum of the school. Any attempt to compel the school curriculum to adapt itself to scholarship requirements is to be deprecated.

"(5) Every scholarship should be divided into two parts: (*a*) educational, (*b*) maintenance.

"A reasonable guarantee should be given by the parents that the holder of the scholarship will retain it during the whole of the period for which it has been awarded.

"The maintenance portion may be taken up by the parents under conditions prescribed by the Education Authority.

"(6) Scholarships should increase in value year by year when held by the same exhibitioner.

"(7) That it is most desirable that each local authority under the Education Act of 1902 should call into conference representatives of teachers in the schools concerned with issuing the regulations, syllabuses, examination test, etc., in connection with all scholarship schemes.

"(8) That a parliamentary return should be asked for, setting forth the total amount of money at present available, from all sources, for the purposes of providing scholarships, bursaries, and exhibitions from the elementary schools within the area to places of higher instruction in each local authority area under the Education Act of 1902."

Dr. Macnamara fortified himself with letters recommending his proposals from Sir John Gorst and Mr. Morant. The Secretary to the Education Department announced that the Board of Education "will gladly see to what extent they can assist in obtaining information in due course as to the provision of scholarships on some such lines as those suggested in No. 8."

"Salaries of Teachers" occupied the rest of the session. The subject was introduced by Mr. A. R. Pickles, B.A., in a speech full of good points and replete with epigram. Mr. Pickles invariably does well at Conference, and is marked out for high honours very speedily. An "equal pay for men and women amendment" was lost before the mover had got half through his speech, although the seconder, Miss Hall (Dartford), made a spirited attempt to save the situation.

TUESDAY AFTERNOON.

What can I say about the first of the "Private Sessions"? Little or nothing that is good, anyhow. The tangible results of three hours' weary discussion were:—

1. £100 voted to Mr. Peaker.

2. Suitable souvenir to Mr. T. H. Jones
3. Death of the N.U.T. Library.

For thirteen years Mr. Peaker has served on the Executive, and for the last eight of these he has been chairman of one of the most important of the Executives' standing committees—the Finance, Press, and General Purposes Committee. But he has been much more than this. Being out of school, he has investigated scores of tenure cases, some in the most remote corners of England and Wales, and undertaken educational inquiries of a delicate and responsible character. He has been, in fact, to all intents and purposes, an unpaid official of the Union, and in this capacity saved the Union hundreds of pounds. I was glad to find the motion carried practically unanimously, a feeble attempt to limit the sum to £25 receiving only a dozen votes. Mr. Peaker was naturally a little overcome when thanking the Conference; and those of us who know him personally, and appreciate his true worth, thoroughly realise how hard it is for him to part company with the Union's work. Very few words were needed to persuade Conference to instruct the Executive to recognise in suitable style the magnificent services of Mr. T. H. Jones, as Chairman of the Tenure Committee; and then we came to the annual heckling of the Treasurer, who, though far from well, would not neglect the call of duty. On his report an amendment was moved instructing the Executive to discontinue the Library after the end of the present year. This was easily carried, so there will be some cheap books going for those who like bargains. The report of the Examiners of Accounts—how euphemistic this always sounds!—struck me as the very antithesis of what such a report should be. Statements, both written and verbal, were made which would excite a howl of derision and contempt were they made by H.M.I. on a teacher's work, and in two notable instances references had better been left unsaid. In the first, Mr. Yoxall, with infinite delicacy and tact, referred to a mere matter of office routine; in the second, Mr. Marshall Jackman—than whom there is no harder worker nor more honourable member of the Executive—literally "wiped the floor" with his traducer. The travelling expenses of the Executive filled in the remainder of the dreary three hours.

TUESDAY EVENING.

The Conference Dinner was the *pièce de résistance*, and was attended by some 250 ladies and gentlemen, including the Mayor and Mayoress of Portsmouth, the Mayor of Southampton, Mr. Reginald Lucas, M.P., Alderman W. Ward (Chairman of the Portsmouth Education Committee), Sir John Baker (a former M.P. for Portsmouth), the Vicar of Portsmouth, the foreign delegates, and all the Union leaders. The speeches were admirable throughout, and, *mirabile dictu!* not one of them seemed too long. The toast of "The Ladies" was entrusted to Mr. A. S. Caudle, one of the genuine humorists of the Executive, and he convulsed the diners with his witticisms. The Royal Marine Artillery String Band discoursed sweet music during the dinner, and interspersed between the toasts was an acceptable musical programme.

WEDNESDAY MORNING.

Considering we were at Portsmouth, it was quite in accordance with the fitness of things that the first subject to be considered was the position of the naval schoolmasters, although the order of business had to be suspended for the purpose. Mr. Sandford, who hails from Gosport, being thoroughly *au courant* with the subject, related to the Conference some startling facts, and it needed little or no persuasion to pass a resolution calling the attention of the Admiralty to the urgent necessity of increasing the attractiveness of the naval schoolmasters' *métier*. The main subject of discussion was what has been termed the "St. Asaph Concordat," and a comprehensive resolution was moved by Mr. Marshall Jackman—through whose persistence at the Executive the matter was brought forward—which said in effect, "Hands off the council schools!" In the debate all the heavy artillery of the Union was called upon. Mr. Jackman himself opened in capital style, and was seconded by Mr. T. B. Ellery, a former President of the N.U.T. and a "voluntary" teacher. Then we had, in turn, the three teacher M.P.'s—to the delight of the Conference neophyte. The original motion was carried, with this tactful addition by Mr. Gray, M.P.: "But this should not prohibit the establishment of special conditions respecting voluntary schools leased to, or otherwise placed under, the complete control of the Local Authority." "Salaries" then had another turn, after which Mr. J. Litt (Hackney) introduced the burning question of "Examination *v.* Inspection." In the course of his remarks he gave an amazing account of inspectorial vagaries in East Lambeth.

Certain "hardy annuals" dealing with the Size of Schools and Classes, the Staffing of Schools, and "The Teachers' Register" were next agreed to *nem. dis.* and without discussion, and the session wound up with the votes of thanks to the local workers, and the presentation of Mr. Coward's illuminated address—a beautiful example of Mr. Blake Hadlow's art and the workings of Mr. J. F. Blacker's fertile brain. I may as well say here that the President's eloquent words of praise to the local committees were not one whit too strong. Every conceivable arrangement had been made for the comfort and convenience of the two thousand delegates, and during the whole week I heard nothing but praise for their work. Courtesy and kindliness and business-like aptitude permeated the whole of the Portsmouth teachers, from Mr. A. R. Samphire, the worthy Conference Committee Chairman, down to the humblest committeeman, and the result was that everything went off "with a click." Just before the session terminated, Mr. W. Tegarty expressed the thanks of the Llandudno Teachers' Association and the Llandudno Urban District Council to the Conference for the acceptance of their invitation to hold next year's gathering in North Wales. Every one who knows Mr. Tegarty is certain that he (and his colleagues) will spare no effort to make the 1905 Conference a "record" one in every respect.

WEDNESDAY AFTERNOON.

The second of the "private sessions" was a shade less unsatisfactory than the first. Certainly the attendance was the thinnest I have seen at Conference for many years. The discussion was renewed on the expenses of the Executive, and the unusual sight was seen of two ex-Presidents of the Union, Messrs. Coward and Allen Croft, "taking the gloves off" on behalf of their Executive colleagues, and to such good effect that one hopes this matter is now settled for all time. As a sort of reaction, possibly, Conference thanked the Executive for their past year's services in a fashion never before witnessed, the whole of the delegates rising in their places and cheering most heartily. The President's acknowledgment, commencing, "I have read in the Old Book, 'Whom the Lord loveth He chasteneth,'" was dignified and singularly *à*

propos. The best thing accomplished this afternoon was the unanimous passing of a scheme for the superannuation of the Union's officials. Under it the following amounts will be received :—The General Secretary, £200 per annum ; the Assistant Secretary, £180 ; the Education Committee Secretary, £180 ; the Legal Department Official, £150 ; each Senior Clerk, £75.

Messrs. Peaker and Burkett deserve every credit for the skill with which they piloted the scheme through Conference. Last of all came the vote of thanks to the President, entrusted to the capable hands of Mr. James Scotson and Mr. Mieras, one of the Dutch visitors. Needless to say it was carried amid thunders of applause, for Mr. George Sharples had been a magnificent success in the chair from start to finish. Every one knew in advance that he would make one of the best Presidents the Union has ever had, and possibly he exceeded the anticipations of his most sanguine admirers. The emotional side of his nature, which I (for one) feared might prove a stumbling-block, actually proved to be a source of strength ; for Conference likes a man with "a big heart." To say that he was courteous and dignified and eminently fair is only to say that he was himself all through ; and whatever diverse opinions might be held of the success of the Conference itself, there could be none about the way in which Mr. Sharples maintained the best traditions of his high office. May he long be spared to serve his fellow-teachers, and may increasing happiness come to him and his as the years roll on !

WEDNESDAY EVENING.

This was devoted to College Reunions, the Ladies' "At Home," and the Annual Meeting of the Non-Collegiate Certificated Teachers. I heard that the Ladies' "At Home" was the most successful function of its kind ever held in connection with Conference, and the *Portsmouth Evening News* caused a flutter of excitement by including a description of the ladies' dresses. To myself—a mere man—the most (dare I write ?) amusing line was, "Miss X. was wearing cream with scarlet." The College Reunions were hearty enough, though there was a general complaint with the accommodation supplied at certain of the hostelries. This, I am sure, was unavoidable.

THURSDAY.

This day, according to custom, was given up to the Annual Meeting of the B. and O. Funds and the "Presentation of Purses." I spent the morning in the Publishers' Exhibition, so missed the business meeting, but made a point of attending that particularly interesting ceremony the "Presentation of Purses." A noble sum of £18,252, 2s. 8½d. was handed to the gracious Mayoress —and it was with peculiar pleasure that I saw both the Birmingham Trophy and the West Yorks Shield come to Nottingham, my own city.

FRIDAY.

The excursions to the New Forest, Isle of Wight, and Winchester were all well patronised, and favoured with magnificent weather. I shall not readily forget the glorious drive some two hundred representatives had from Ryde to Ventnor, *via* Ashey. The return journey, *via* Shanklin (with its world-famed "Chine"), Sandown, and Brading, was, if possible, still more beautiful.

L'ENVOI.

Had there been *no Conference*, 'twould have been a glorious week ! No great question, except possibly the "St. Asaph Compromise," occupied the Public Sessions, whilst the one good result accomplished in the Private Sessions was the establishment of a useful and necessary scheme of "Pensions of Officials." No new reputations were made "on the floor," and on the platform the only gentlemen who added to their prestige were Messrs. A. R. Pickles and Shawcross. The Union will be ever indebted to the public-spirited Portsmouth teachers for the marvellous success of all their arrangements, and to Mr. George Sharples, who has shown those who come after him the way to live in the memories of his fellow-teachers.

THE PUBLISHERS' EXHIBITION.

Mr. Allen was quite right when, responding to his share of the votes of thanks, he described this year's Publishers' Exhibition as the finest ever seen at an N.U.T. Conference. Not only were the exhibits themselves of the highest possible quality and quantity, but they were nobly housed, and visitors could wander round, sipping and dipping and tasting wherever they felt so inclined, without being jostled, or in any way crowded. I have been attending Conferences for nearly twenty years, and although I spent more time in the exhibition this year than in all my preceding years put together, I am afraid I did not see half of the excellent publications, maps, pictures, apparatus, etc. These scrappy notes must therefore be taken as referring to what I myself saw ; but *ex pede Herculem*.

Messrs. E. J. ARNOLD AND SON (Leeds) were responsible for one of the largest and best shows in the exhibition. A fine series of A. L. History Pictures included such stirring scenes as the Death of Harold (Battle of Hastings) and Landing of William of Orange ; and although they looked a trifle highly coloured when close together on a screen, they would certainly look well apart on drab school walls. The A. L. Photographs are fit for a palace, whilst the babies will simply revel in the A. L. Nursery Pictures, of which I noticed Jack the Giant Killer, Babes in the Wood, Red Riding Hood, etc. Then there were models of the seashore (with donkeys, bathing-machines, etc.) and the desert (with models of camels, oasis, sand, *et hoc genus omne*). Messrs. GEORGE BELL AND SONS, besides showing a fine collection of books for secondary schools and students, had on view a splendid new edition of *Webster's Dictionary*, profusely illustrated and well printed. Messrs. G. W. BACON AND CO. had a capital exhibit of maps, pictures, and general educational publications.

I lingered long round the stall of Messrs. BLACKIE AND SONS. Their Brush Drawing Sheets are amongst the very best in the market ; whilst for those teachers who are not quite "whole-hoggers" there are a fine series of Poynter's designs, to be filled in with a "flat wash." Their School Library of sixty-six choice books is well known, and their Red Letter Library of English Classics is so beautifully produced that it would have satisfied even the author of *Sesame and Lilies*. I should like to possess them all. For ordinary school work the New Century Geographical Readers (with coloured illustrations) and Nature Knowledge are quite first-class. Their secondary exhibit included Shaded Drawings of Models for class teaching and S. K. Drawing Sheets (coloured), Plant Form. Messrs. Blackie's Reward Books, too, are well worth purchasing. Messrs. BLACKWOOD AND SONS showed their series of English Classics (in which I noticed Johnson, Lamb, Pope, Milton, Carlyle, Scott), and a Classical Texts series, wherein Homer, Tacitus, Virgil,

Montaigne, Dante, and Schiller were conspicuous. Their "Story of the World" reading books are a capital set of five, for the teaching of history and geography combined, dealing with the happenings from 450 B.C. to 1903 A.D. Each book contains a map showing the world as known at the period of the volume.

Messrs. W. AND R. CHAMBERS showed, amidst many other excellent publications, an Etymological Dictionary of 608 pages, price *one shilling, net*. This is truly "prodigious." Their Object Lesson Sheets, of which the Garden Rose, Sunflower, Knife, Rabbit, Buttercup were exposed, pleased me greatly, as did their Gift Books, with attractive bindings, and their Twentieth Century Readers—these last superbly illustrated. Messrs. J. B. CURWEN AND SONS exhibited apparently every requisite for the successful teaching of music in schools, and in addition a choice selection of high-class music. The CAMBRIDGE UNIVERSITY PRESS showed a wonderful collection of works on education, comprising many old friends. A Historical and Mathematical Series and some school selections of Scott's works attracted much attention. The exhibits of Messrs. CHAPMAN AND HALL were a veritable *fête des yeux*. Their series of carbon photographs, amongst which is Millet's "Angelus," charmed one straight away. For twenty shillings net one can have a picture, 17 × 23 inches, mounted on board 27½ × 34½ inches, which is absolutely fadeless. Single prints, 5½ × 8 inches, can be had for sixpence. I was struck by a series of casts showing the various stages of wood-carving, as well as by a fine series of Botanical Diagrams.

The EDUCATIONAL MUSICAL INSTRUMENT CO. (Huddersfield) showed a variety of high-class specialities, including a "Perfecta" pneumatic piano-player, price thirty-two guineas, manufactured by Morton Brothers. Their over-strung, upright grand pianoforte, with all the latest modern improvements, seemed cheap at £36. An American organ, with fourteen stops and six sets of reeds, and costing £17, was greatly admired, as was also a school piano in solid oak, price £20, and specially constructed for school use. Messrs. GINN AND CO. exhibited American Nature Books, including those fascinating and charming works by William J. Long—*School of the Woods*, *Beasts of the Field*, *Fowls of the Air*, and *A Little Brother to the Bear*. These stand alone, in my estimation, and are a source of never-ending delight to every lover of nature. The "Wood Folk Series," price 2s. 6d., is just the thing for boys and girls at school. Messrs. HARDTMUTH made an attractive display of Koh-i-noor Pencils and "Ideal" Fountain Pens. A case crammed with medals and distinctions surmounted the whole, and was evidence of appreciation in many countries. The exhibit of Messrs. W. AND A. K. JOHNSTON (Edinburgh) included splendid globes, war maps, the "Navy League" map, cooking diagrams, diagrams on hygiene illustrating popular health lectures (edited by R. J. Collie, M.D.), and a capital chart of the metric system of weights and measures. The Bill at present before the Lords Committee will no doubt quicken the interest in this most useful chart. Messrs. LONGMANS, GREEN, AND CO. exhibited their "Ship" Series of readers, which certainly require no commendation at this time of day. Their New Supplementary Readers—*Tales of the Fairies*, *Tales of the Bran Tub*—are bound to delight, whilst their Chatty Readers in elementary science are really admirable.

Of Messrs. HORACE MARSHALL AND CO.'s exhibit I was most taken up with the Romance Readers, edited by Miss C. L. Thomson. These readers, entitled *Tales from the Greek*, *Stories from Latin Poets*, *The Celtic Wonder Book*, and *Children of Odin*, are entertaining, and quite out of the beaten track. A series of six historical pictures taken from old tapestries are distinctly novel. Messrs. MEIKLEJOHN AND HOLDEN showed books for London Matriculation, College of Preceptors, Oxford and Cambridge, P.T. and Scholarship Examinations. I noticed that their geography books are revised from the latest available statistics. The well-known firm of Messrs. MACMILLAN AND CO. were naturally much in evidence. I was greatly pleased with their Globe Geographical Readers (by V. T. Murché, F.R.G.S.), comprising an introductory, junior, intermediate, and senior class-book. Some of the coloured illustrations were exceedingly good. The Globe Poetry Books are finely printed, and the selections made with excellent taste and discrimination. A shilling edition of *Alice in Wonderland*, *Through the Looking Glass*, and *The Cuckoo Clock* will charm the juveniles. A set of Nature Study Drawing Cards by I. J. Williams, in eight sets (20 alike), where the actual leaf—lilac, clover, woodsorrel, ivy, rhododendron, oak, maple, or strawberry—is given on each card, will prove most helpful.

The NATIONAL SOCIETY showed, amongst other things, a new edition of Miss Yonge's Historical Readers, and a series of nine new maps with bold outlines and the physical features well set out. Some Scripture Prints, adapted by J. E. Goodall, were nicely coloured. Messrs. GEORGE PHILIP AND SONS, LTD., exhibited many of the charts and maps for which they are so deservedly renowned. A useful chart contained diagrams and synoptical tables of the metric system of weights and measures. Their Relievo Test Maps, though on the small side, were excellently produced; and the same must be said of their "Comparative" Series of Maps, printed in four colours to show the land's elevation. Philip's Picture Map of the World, showing pictorially the natural productions and manufactures of all countries and the commercial highways by land and sea, would be useful in any school. Their globes and Nature Study Drawing Cards are, of course, worthy of the firm. Messrs. Philip have also an excellent Natural History Series, framed complete, at seven shillings per picture.

The firm of Sir I. PITMAN, originally devoted entirely to works on shorthand, exhibited books which stamp it now as one of the leading houses of general school publications.

Messrs. REEVES AND SONS' exhibit of artists' materials, including crayons, boxes of colours, and mathematical instruments, colour tubes and pencils, was a lovely and artistic display which added to the brightness of the general exhibition. Lastly, Messrs. THOS. NELSON AND SONS, the proprietors of this journal, had a fine show of their leading educational publications and productions. I was struck by the *Royal Portfolio*, *World and its People* (Geographical Series), *Nelson's New Drawing Course*, and *Plant Life*—a particularly capital set of pictures and diagrams for object lessons. The *Practical Teacher* and the *Practical Teacher's Art Monthly* were conspicuous features on this stall.

I end as I began—by declaring that this is only an account of what I myself saw and handled. It is only fair to state that, in all probability, this account may be remarkable for its omissions; but it would have taken the whole of Easter week to see *all* that was good, and these samples must, for the nonce, suffice.

THE ART OF OLD JAPAN.

BY STEWART DICK.

JAPAN stands to-day in a curious position. Only fifty years ago she was a nation living under the conditions of feudal England, and shutting herself off jealously from all contact with the Western world. Now she stands out from all Eastern nations as the one most eager and ready to adopt Western ideas, as the one who has advanced farthest towards Western civilisation.

For thirty years she has been a diligent scholar, choosing her teachers from the best the modern world can supply. Her army, her navy, her financial system, her manufactures—all these she has formed under the guidance of specialists, and with the benefit of the accumulated experience of European and American civilisation. And now, marvellously quick to adapt herself to the new conditions, she has outgrown her period of pupilage, and is stepping forth as a modern nation, a power to be reckoned with in moulding the destinies of the East—ay, in moulding the destinies of the world.

It is a wonderful change in little over half a century, but one wonders whether it is altogether a change for the better. What has Japan gained, and what has she lost? what has the world gained, and what has it lost? The new Japan bids fair to develop into a great industrial nation, rivalling those of the West. But the arts which were the glory of the old Japan, that are unsurpassed, and in some respects unequalled, by any the world has seen, are decaying, smitten with the blight of commercialism, the canker that has eaten so deep into the heart of Western civilisation. Can she retain them—nay, rather can she recover them, or must they soon be but dreams of other and happier days?

It is only within the last fifty years that Western nations have really seen the art of Japan, and at the beginning they fell into the error of regarding it as the work of a barbaric nation. Never was there a greater mistake. Doubtless the canons of European art differ widely from those of Japan, but these things are not essentials. All art is based on convention, and before we can understand Japanese art we must accept their conventions—we must know the language of their art. The truth is, that it was too subtle for us, too refined. We are only now beginning to realise its finer qualities. As a nation the Japanese have for centuries been cultured, in an æsthetic sense, to an extent far beyond our Western conceptions. One is called a visionary and a dreamer here if one hopes to see the day when the pleasures of art shall be the solace of the poor as well as the luxury of the rich; but that has been the case in Japan for ages. On the public highways there you find notices calling the attention of the wayfarer to the points from which the finest views may be obtained. The artisan mother in the city takes her babe out into the public parks at the festival of cherry blossom, that its infantile mind may be permeated by the beauty and fragrance of the flowers. To learn to write there is a course of training in drawing. The Japanese craftsman is the finest the world has seen. What wonder that with such a public the art of Japan should be somewhat over our heads! The Philistine bulks largely in the Western world, and must be considered and propitiated at every turn; but he does not exist in Japan. And so in Japanese art it is always the subtle rather than the striking effect that is sought after. The delicate rather than the strong, reticence rather than exuberance, elegance rather than richness, are its characteristics.

Of late years, indeed, some of our leading artists are beginning to acquire the qualities which Japan has loved so long. The work of Whistler, in particular, in its sensitive feeling for balance, in its grace of line, in the unerring instinct which marks its spacing, in the delicate harmony of its colour, is essentially Japanese in style. Whether these traits were consciously borrowed from the Japanese, or whether the artist evolved them from his own inner consciousness, matters little. The essential fact is that the qualities which mark the work of one of the greatest of our modern painters, and distinguish it from that of the vast body of his contemporaries, are just those qualities which for centuries have marked the art of Japan. It is interesting, however, to know that Whistler was a great admirer of Japanese art. In this respect he was not alone among British artists, for Lord Leighton was equally enthusiastic, and the collection of colour-prints which was sold on his death was one of the finest which had been brought together in this country, and to the novice a revelation of something entirely new as well as exquisitely beautiful.

The basis of all pictorial and applied art is architectural, and here we find the starting-point of difference between the styles of the East and West. The frequency of earthquakes in Japan has rendered impossible the erection of buildings of the solidity and imposing proportions of those which mark our Western cities. In the Japanese house the walls are merely paper screens, the whole weight of the roof being supported by the four corner beams. This lightness of construction dictates the course taken by the arts of Japan. Pictures, instead of being enclosed in the massive frames to which we are accustomed, are painted on light strips of silk or paper, and mounted on rollers, as we mount a map. Household furniture, too, is reduced to a minimum. A few mats to sit on—for the Japanese use no chairs—one or two paper screens dividing the house into separate chambers at will, some lacquered trays, a few articles of pottery and simple cooking utensils—that is all; and these, with a few personal belongings, form the whole field which is open to Japanese art. By its restricted nature the work has been affected in two ways. It has never been the aim of the artist to turn out large quantities of work; he would patiently expend years of labour on one article. Then his labour being so much expended on such articles as the two-handed swords of the Samurai, the *inro* or medicine box, or other personal appurtenances of a small size, he became a perfect master of the art of *multum in parvo*. The whole history and mythology of Japan may be read in the beautifully-wrought *netsukés*, or buttons, which attached the *inro* to the girdle, small knobs of wood or ivory little larger than a walnut. Yet in this small field the Japanese carver combines astonishing power and vigour with the most exquisite finish.

The civilisation of old Japan, now so changed, was the slow growth of many centuries. With all their receptivity and quickness to adapt themselves to new conditions, the Jap has yet a strong vein of conservatism. For more than twenty-five centuries, if we may believe the ancient records, the Mikado and his forefathers have been absolute rulers of Japan, the present dynasty

stretching back in unbroken line to about 660 B.C. But, as written history did not exist till some centuries after the beginning of the Christian era, the records of these early days are of a more or less legendary character.

The origin of the Japanese race is shrouded in mystery. Little more of them is known than that, somewhere between two and three thousand years ago, they invaded Japan and drove out the Ainos, who still survive in the island of Yezo. A Mongolian race, no one can say positively whether the invaders came from China or Korea, from the Malay Peninsula or Siam, or whether, indeed, they were an offshoot from the wild Huns against whom China raised the Great Wall. One thing which tends to show that at any rate they were not a branch of the Chinese race, is that, even at that early date, China was the abode of an old civilisation, while the Japanese were certainly little removed from barbarism, and in fact hardly more advanced than the Ainos whom they displaced.

Among the earliest specimens of Japanese art are rough clay images of human figures which formerly were buried with the dead. The following account of the origin of this custom is quoted from an ancient chronicle: — "Those who had been in the immediate service of the dead chieftain were buried upright round his sepulchre alive, only their heads being above the ground; and for many days they died not, but day and night wept and cried. At last they died and rotted. The Mikado, hearing the sound of their weeping and crying, felt saddened, and called upon his ministers to devise some means of obviating this cruelty. Whereupon one of them directed the potters of that time to make images of clay to bury in place of living men round the tomb."

A JAPANESE BEAUTY.
(From a Colour Print.)

The Japanese character, however, has always been receptive, and just as their new civilisation is borrowed from Europe, so for the foundations of the old they were indebted to China. It is said that about 157 B.C. the use of Chinese characters was introduced from Korea, and in the third century of the Christian era the Empress Jingo, after a victorious invasion of Korea, brought back with her the first books introduced into Japan. The leaven soon began to work, and, some years later, the Emperor Ojin engaged a Korean professor to instruct his son in Chinese literature and classics, and with Chinese learning Chinese art and industries were introduced into the country.

But the real civilising of Japan began with the arrival of the Buddhist priests in the middle of the sixth century. Buddhism became the general religion of the country, absorbing, though never superseding, the collection of old superstitious beliefs known as Shintoism. Shintoism was hardly a religion in the usual sense of the word, for, as an old Japanese writer admits, it had no moral code; but he adds naïvely, "Morals were invented by the Chinese because they were an immoral people, whereas in Japan there was no necessity for any system of morals, as every one acted rightly if he only consulted his own heart."

Soon the Buddhist monasteries became the great seats of art and learning, just as were our own mediæval cathedrals and abbeys, and in the peaceful time between the eighth and tenth centuries literary culture reached a high level, several of the most famous poets of Japan, whose writings still live in oral tradition, being of this period. Art also made rapid strides. The temples were ornamented with beautiful carving, and contained sculptured figures of no mean order. Among the finest examples which now survive are the figures of Indra and Brahma, the *nio* or temple guardians, which stood at the gates of the temple of Kobukji. These images are carved in wood, and are rather more than life-size; powerful and terrible grotesques, with all the Japanese quality of exaggerated facial expression and gesture. The colossal bronzes of the temples, huge images of Buddha, sixteen or twenty feet high, marvels of casting, are still the wonder and admiration of the world; and very beautiful work also characterised the delicately-pierced bronze lanterns, and the massive temple bells. By the eighth and ninth centuries the art of metal chasing had risen to great perfection, while the armour of the tenth century was of exquisite workmanship, wrought in the thinnest but hardest metal. At this period, too, we have the beginnings of the beautiful lacquer work of Japan, and also the rise of the potter's arts.

The Buddhist paintings, with their strong devotional feeling and the rich magnificence of their colouring, have much in common with the gorgeous illuminations of our own mediæval monasteries. They were for the most part unsigned—the holy men refraining from contaminating sacred themes by such earthly associations. Even now the Buddhist priest will reverently raise such a painting to his forehead before carefully unrolling it for inspection. Closely bound by tradition, there was, however, little room for development or expansion in the Buddhist school of religious art.

An artist arose, however, in the tenth century—Kanawoka—a court painter rather than a priest, who enjoyed a widely-spread popular reputation. Although no examples of his work are known to exist, his name is still a household word, numerous legends clustering

round it. His horses were especially famous, and regarding them the following story is told:—In Ninnaji Temple, near Kioto, was a screen on which Kanawoka had painted a magnificent horse. The peasants of the district were much annoyed by the nocturnal visits of some wild animal, which devastated their fields and gardens, trampling down the flowers and eating the choicest herbs. Lying in wait, they found that the intruder was a great horse of matchless grace and beauty. On their pursuing, it disappeared into the temple; but when they followed, to their surprise the building was empty. As they stood below the screen, however, drops of sweat fell down upon them, and looking up they saw Kanawoka's horse all hot and steaming. A brilliant idea occurred to one of them. Seizing a brush he added to the picture a rope tethering the steed firmly to a post, and the peasants were no longer disturbed by their nocturnal visitor.

But it was in the feudal period, from 1603 to 1867, that the arts of Japan reached their highest point of excellence. From the twelfth century many of the duties of government—the maintaining of order and the execution of justice—were delegated to an official called the Shogun, who held a position second only in importance to that of the Mikado himself. In 1603 this office came into the hands of Iyeyasu, a member of the Tokugawa family, in whose house it became hereditary, remaining so until 1867, when it was resigned to the Mikado. The Shogun, in fact, under the Tokugawa régime, became the virtual ruler of Japan, holding a court of his own at Yedo, while that of the Mikado, the nominal ruler, was at Kioto.

When Iyeyasu became Shogun, the country was in a very unsettled state, the local lords, or Daimios, having assumed absolute power in their own districts, and being frequently at war with one another; but he speedily reduced them to the position of vassal princes owing feudal obedience to the Shogun. Their immediate retainers, the Samurai or military class, formed the aristocracy of the nation, and beneath these were the trading, the agricultural, and the artisan classes. Those are the divisions of Japanese society which lasted from that time until the revolution of 1867.

Under the feudal system the country appears to have been well governed, the people industrious and happy. William Adams, an English seaman who was cast away on the Japanese coast in 1600, found the country so much to his liking that, having been kindly received by the Mikado, he remained there till his death in 1620. He writes home:—"The people of Iapan are good of nature, curteous aboue measure, and valiant in warre; their iustice is seuerely executed without any partialitie upon transgressors of the law. They are gouerned in great ciuilitie—I meane not a land better gouerned in the world by ciuil policie."

The Shogun Iyeyasu, a man of great ability, was an enlightened patron of the arts, and, following his example, the Daimios took a fatherly interest and pride in the arts and industries of their provinces, specimens of which were periodically sent to the courts of the Mikado and Shogun. Artists, many of them men of good family, were highly honoured, and in the households of the wealthy Daimios, freed from all sordid cares, were able to devote themselves entirely to their art. Time to them was nothing—the final result all.

It was under such conditions that Japan produced those marvellous works of art for which she stands pre-eminent among the nations of the world. Exquisite metal work adorned the treasured swords of the Samurai—low-toned ornamentation, hardly assertive enough for our modern European taste, accustomed to a more showy brilliancy, but rivalling in originality of design, while it far surpasses it in minuteness of detail and beauty of finish, the finest work of the Middle Ages.

At this time, too, the wonderful lacquer work, the most characteristic and most exquisite of all Japanese arts, reached its greatest beauty. The process is long, and requires the most delicate manipulation. The article to be treated is painted over with the lacquer—a resinous gum obtained from the "urushi" tree—allowed to dry slowly, and then rubbed down with powdered charcoal until absolutely smooth. Then another coating is added, and another and another, days

Drawing by an Artist of the Kano School.

and sometimes weeks having to be allowed for the drying of each layer. The result is a surface as hard and as smooth as glass, and with a rich, glossy transparency. Embedded in the lacquer, or standing out in relief from it, is the most beautiful inlaid work in gold, silver, mother-of-pearl, and other substances. In the household of the Daimios an artist would work months on one article; his reputation was based on the quality not the quantity of his work, and a year's labour would often be expended on a little *inro*, or medicine box, a few inches square. We can readily see how such an art deteriorated under modern commercial conditions.

Japanese pottery and porcelain, too, soon showed themselves worthy of a place beside the other applied arts. Borrowing his art originally from China, the Japanese potter, in this field as in others, gave his

work a quality and a character essentially distinguishing it from its prototype. In comparing a Japanese with a Chinese collection, one cannot but be struck by the superior refinement of the former. Its decoration is more discreet, its colours more delicate; the Chinese work beside it seems commonplace and often gaudy, for the reticence of the Japanese craftsman is the quality which above all stamps him as a true artist.

Perhaps the most famous potteries were situated in the province of Hizen, and their products, shipped from the port of Imari by the old Dutch traders—the only Europeans allowed to deal with Japan—were known as Imari ware. It found a ready market in Europe; but we must always remember that the ware exported by the Japanese often differed extremely from that which they made for their own use. The one was made to please the barbarous foreigner, the other to gratify their own exquisite taste. Many of the old wares have now almost fabulous values, especially as, the processes being expensive, the larger pieces were only made occasionally when required by important personages.

From a Drawing by Korin.

To the European, "old Satsuma," familiar though the name be, is a thing hardly ever seen, clever imitations supplying its place in many modern collections. At first Satsuma ware, with its rich creamy colour and finely-crackled glaze, was left entirely unadorned; but the choicest specimens, dating from about the beginning of the nineteenth century, are beautifully decorated with gold and over-glaze colours.

Of special interest to the antiquarian are the utensils used in the tea ceremony, a special kind of ware called Raku ware being made specially for the purpose. These tea bowls are of a rough soft clay, admirably adapted for retaining the heat of the liquid, and are not thrown on the wheel, but rudely modelled by hand, with little or no ornamentation. They were highly prized, being often gifts from one dignitary to another.

The art of painting, as we have seen, arose in the old Buddhist monasteries, and the first school was entirely religious. Hedged in by tradition in subject and treatment, its tendencies were always conservative, and it lasted with little change till the fifteenth century.

Following Kanawoka, a secular branch had arisen in the eleventh century, which ultimately took form as the first really national school of Japanese painting—the Yamato, afterwards known as the Tosa school. Their subjects were largely drawn from bird and flower life, and their pictures were finely finished and full of delicate detail.

In the fifteenth century a new influence made itself felt with the advent of Sesshiu, the great landscape painter; and shortly after his death, and affected largely by his influence, Kano Masanobu, and his still greater son, Kano Motonobu, founded the Kano school. Its leading characteristic was a bold, sketchy style of work. Many of the paintings were executed in black and white, and the sweeping brush work is masterly in its ease and expressiveness. From no period of Japanese art can the European learn more than from this, and the black and white work of the younger school in this country shows how well the lesson has been taken to heart.

The next step was the founding, in the end of the sixteenth century, of the Ukiyo-ye ("passing life"), a popular school of painting which took its subjects from everyday life, and in an offshoot of which afterwards originated the art of colour printing.

During the seventeenth century arose one of the greatest of all the Japanese artists—Korin. His work is full of great force and originality. His slightest sketch was a finished work of art, possessing in a marvellous degree those qualities of poise and balance which render Japanese work so delightful, but with also a rarer element of strength. He had a tremendous influence on Japanese art, and, to celebrate the hundredth anniversary of his death, four volumes of his sketches were collected, engraved on wood, and published. As a lacquer worker his work was equally bold and original, and often extremely rich in effect. By many he is regarded as one of the few great artists of the world.

The last stage in the history of painting was the rise of the Shijo, or naturalistic school, in the end of the eighteenth century, which treated animals, birds, insects, and plants in a more realistic manner than had hitherto been attempted.

From the Ukiyo-ye school arose a branch of art in which Japan was destined to outdistance all competitors—the art of printing in colours. Early in the seventeenth century Moronobu published books of woodcuts, at first uncoloured, but afterwards tinted by hand when required. Then some one hit on the idea of printing in colour direct from two or more blocks, and the result was one of the most fascinating of all the Japanese arts. It reached its height towards the end of the eighteenth and the beginning of the nineteenth century, and includes among its followers the names of Utamaro, Toyokuni, Yeizan, Hokusai, and Hiroshige, to name but a few of the greatest. It was essentially a popular art. Its subjects were those of everyday life, and by its cheapness its products were within the reach of the poorest. But for this reason its exponents never obtained from the aristocratic classes the recognition to which their qualities entitled them—their work was vulgar, and beneath the notice of the Samurai.

The greatest of all the colour-print artists, and the last of Japan's great artists, is Hokusai, the great popular artist of Japan. His work reflects as in a mirror the whole life of Japan. In the "Mangwa" we have fourteen volumes of masterly sketches illustrating all phases of Japanese life—an encyclopædia of illustration. The Hundred Views of Fuji, the fine series of colour-prints of the Waterfalls, and the Thirty-six Views of Fuji, form an epitome of the land-

scape of Japan seen with the eye of a poet and artist; and countless studies of animals, birds, insects, flowers, and still life complete the tale. He died in 1849, at the age of eighty-nine.

But with the revolution of 1867, the feudal system was swept away; the old laws were abolished, old customs died out, and Japan was thrown open to the Western world. And now, alas, many of the old arts speedily fell into degradation. The Japanese are nothing if not adaptive; and when they found that what was required for the European trade was not quality but quantity, they speedily met the demand, and the markets were flooded with cheap and superficial imitations of the old masterly work.

In the disturbances and civil war which followed the revolution, many of the old temples were destroyed and their priceless treasures scattered or lost. When the two-sworded Samurai were, in 1871, deprived of the right to carry the weapons which for so long had been the proud distinction of their class, the treasured swords, often heirlooms handed down from father to son, came into the hands of foreign merchants to find a resting-place in European collections.

Now, indeed, the Japanese have awakened to a sense of their losses, and the remains of the old work are being carefully collected and deposited in museums—doubtless the best possible course in the circumstances, but one which shows vividly the change from the times when such treasures were to be found in every old family, and formed part of the daily life of the people.

The old times have passed away, and with them the old arts. A Japanese connoisseur, examining an ancient masterpiece, exclaimed, "The artist who could produce an object so supremely beautiful could not have worked from morn till eve; he could only work when he was in a gay and lively spirit." There is no room for this style of work in the modern industrial community.

Japan bids fair to become the first commercial nation of the East; but one may doubt whether she will ever again attain so proud a position as that which, with her unrivalled arts, she occupied in the old feudal days.

"DO IT AGAIN."

IT is a commonplace remark, and one that has almost attained the dignity of a proverb, that "Difficulties make men." Like all such pieces of crystallised wisdom, the fact stated is true within its own limits. But there is also another side—the side that is most usually overlooked by those who make the statement of a proverb the last word in an argument. And this other side has often the larger application, as it has in the present instance. One has not far to go on the road of inquiry before the impression is strengthened that difficulties *break* men more often than *make* them. It can be readily granted that a difficulty overcome makes the victor surer of success when once more he is called upon to attack; and provided there is an easy gradation in the series, the average man may continue to grow. The difficulties of life, however, do not thus always favourably present themselves. They come upon us in overwhelming force, and it is only the giant, physical or intellectual, that by sheer personality forces his way through them. In all other cases the struggle is wasted and the individual is lost. His endurance may have been heroic, but his staying power is at last exhausted; and unless some more skilful friend directs his energies or assists him in his struggle, he at last gives way, exhausted and disappointed, and unconsciously joins the ranks of the fatalists.

What is thus true under general conditions is undoubtedly so in special circumstances. May it not be possible that the dull, backward child—the child without enthusiasm, the drag on the class, and the subject of anxiety to the parents—is the product of the "difficulty" that *breaks*? May he not some time or other have been set tasks by an earnest but unsympathetic teacher, simple in themselves, but at the moment far beyond his undeveloped powers? May he not have struggled and struggled to accomplish, and, having failed, been sent back to his place to "do it again," without any assistance or guide to place him on the right road? And may he not at last have given up in despair, or accepted unintelligently from another pupil the correct result, or even have copied it? If so, from that moment he has given up the fight, for the difficulty has conquered him. So little by little the stronger pupils get beyond him; he falls hopelessly in the rear; is told he is stupid, and finally believes it. This is no fancy picture. Over and over again we have known cases where boys have had their sums marked "wrong," and were sent back to their places to "do them again," when the error was a want of knowledge, and not want of accuracy or care. It is quite necessary to mark exercises that are correct with a distinguishing mark—it is important to ascertain that the award is honestly deserved—but it is far more important that the work that is incorrect should be much more closely examined. In such exercises the teacher will find what he should teach, where his teaching has failed to reach its mark, and what is the capacity of the pupil. While the subject is fresh he can attack it with advantage; and much of the difficulty being thus removed, the child makes a fresh effort, generally with success. By thus finding and attacking the weak spots, the general level of the work rapidly rises, the members of the class retain their childish enthusiasm, and progress in leaps and bounds. There is a vast difference in teachers and the results they secure; but where, under ordinary conditions, a large percentage of dull, mentally inactive pupils are present in a class, the cause may possibly be found in the fact that the teacher believes that "difficulties make men," without having realised that they just as readily *break* them.

We now reach a very important point—namely, the question of the marking of exercises. When and how should they be marked? The best time is undoubtedly at the moment of their completion. The method varies according to the subject and local conditions. An exercise in composition, say of ten minutes, could be *orally* corrected with the best effect directly it is finished. A fresh exercise upon a subsequent occasion, giving practice in the weak points previously discovered, would be the most effective way of dealing with the matter. Deliberate marking in coloured ink, etc., though absolutely necessary in a proportion of exercises, is worthless unless the marking can be made to appeal directly to the pupil through the teacher's personal instruction. Unless this takes place, the marking, except to adult students, is nearly worthless, and the personal teaching loses in value the greater the interval of time between it and the execution of the exercises. The common practice pursued in many schools, of marking exercises worked in one lesson during the progress of the next,

is bad in principle. While the pupils are with the teacher he should be teaching. This does not mean that he should be continually talking. Work that is being done should be supervised in position. Where much written work is done, a time should, in fairness to the teacher and scholar, be set apart for "marking" during the school hours. In all cases where "marking" is done apart from the pupil, it must not be of the usually unintelligent description, but should clearly indicate the steps that must be taken or avoided. In every case the teacher must be conscious of the pupil's difficulty, and from a personal knowledge of his character and temperament afford him that minimum of assistance which shall give him a chance of successfully overcoming it.

MENTAL BACKGROUNDS.

BY J. ADAMS, M.A.,
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(*Continued.*)

THE reason why we are so seldom at cross purposes is that we rarely move out of our own set. All societies are made up of sets or coteries, each of which is marked by the possession of a common series of backgrounds. In dealing with those of our own set we have no difficulty, and dealing with our own set makes up the greater part of life for most of us. It is when we have communication with our political opponents, with members of a different church, with foreigners, even with members of some of the ordinary "anti" societies, that we realise that our ideas do not seem to have the same effect upon our interlocutors as we expect.

Teachers, in a more or less conscious way, feel the need of bringing into harmony the backgrounds of teacher and pupil. Young teachers in particular early discover that their questions do not produce the answers they were intended to elicit. A question is asked, for example, the answer to which is within the range of the pupil's knowledge. It is not a matter of theory. The teacher knows from immediately preceding experience, as well as from more general reasons, that the answer is in the pupil's mind, only waiting to be drawn out. Indeed the question is merely a stage in the process of making clear and distinct an idea that the child already possesses, though in a vague way. The question, however, is so clumsily expressed that the pupil, with the best intention in the world, cannot discover against which background the teacher would like to project the ideas concerned. Accordingly, the pupil projects them against the first available background, in the hope that this may be the right one.

"How did David the Second of Scotland die?" asks the teacher, speaking from a background of compounded history and pathology. The pupil answers from a background of genealogy, that happens to be raised by a paragraph in his book, with the laconic "Childless."

The difference of backgrounds is even better illustrated by the following:—

"Why was Monmouth beheaded?"

"Because he stole peas."

Here the teacher's background is political-historical, the boy's romantic-personal. In his book he read that Monmouth was captured in a ditch with his pockets full of peas. Against his schoolboy background the punishment may have seemed a little severe, but not impossible.

To meet misunderstandings of this kind, the young teacher often falls back upon a more or less illegitimate way of harmonising the backgrounds of teacher and pupil, which I generally condemn under the name of category-suggestion. This is how it works. The teacher wishes the pupil to give a certain answer, and instead of asking such a question as would initiate a logical process leading to the required answer, he brings forward some idea which of itself suggests the idea that he wishes the child to express. The commonest form is exemplified when the teacher wishes the child to give a certain quality of an object under discussion. Some such vague question is asked as, "What do you notice about this that I hold in my hand?" Naturally the answers are of all sorts, and probably do not include the special answer the teacher is waiting for. Accordingly, he gives the pupil help in this way. "Is it green, or yellow, or *what?*" The child, of course, sees that colour is referred to, and gives the proper reply; but the legitimate question is in such a case, "What is the colour of this object?"

An amusing case occurred in actual practice. The student teacher asked, "Which minister of George the Third was mainly responsible for the American War of Independence?" Getting no reply, the teacher varied the question in several ways, seeking in vain to give the pupil some help. At length he hit upon a successful expedient. "What is the opposite of south?" he asked, and at once got the triumphant answer, "Lord North."

It is now clear that the management of mental backgrounds is an important part of the mystery of teaching. Accordingly we must study the mechanism of these backgrounds—we must learn the laws of mental scene-shifting. It will be convenient—though there is no fundamental psychological distinction between the two parts—to consider separately the changes operating among the component parts of a background, and the complete change of backgrounds as a whole.

When we consider merely the elements out of which they are composed, we have three main kinds of mind in respect of background.

The first may be named the *rigid*. It is characterised by the close connection among its component parts. Instead of moving freely among themselves, the ideas form a combination once for all, and decline to separate. This corresponds to what happens in a kaleidoscope when the broken glass is supplied in ready-made combinations. The rigidity may be the result of the emotional tone; we may refuse to break up our combinations because we prefer the elements arranged in that way. This is the case with the stubborn little cottage girl who in Wordsworth's poem refused to break up the combination of her brothers and sisters into a group of seven, merely because two of them were dead. The poet does his best to break the combination:—

"'But they are dead—those two are dead;
Their spirits are in heaven!'
'Twas throwing words away; for still
The little maid would have her will,
And said, 'Nay, we are seven!'"

Very frequently this rigidity is the result of bad teaching—teaching for immediate results rather than for the sake of the training involved in the process of learning. It saves time to present ideas in ready-made combination—in intellectual made-up boluses. Educa-

tion, however, should be freed from the trammels of time conditions. The ultimate result is the only thing worth considering. We are not here concerned with the practical difficulties of supplying the best possible equipment for life's work in the limited time at the disposal of the average child. Few questions are of greater importance than that of making the most of the short school time available for the artisan class. But at present our aim is to get at the best ideal state. Once this has been determined, we may be in a position to discuss what compromise will lead to the best result as a compromise. Obviously we must know the best possible, before we can examine how closely we may approach it without overstepping the limits of our powers.

To prevent rigidity, then, the best means is to present the component elements in as simple a form as possible—that is, not merely in the easiest form possible, but as nearly as may be in the forms resulting from ultimate analysis. The mind must make its own combinations. It does not at all follow that the mind will make a combination different from that made by the teacher who prepares his ready-made boluses. But there is a fundamental difference in psychology between ideas grouped by the mind itself, and the same ideas in the same grouping presented ready-made as the result of the operations of another mind. Even when the mind has made its own combinations of ideas, there may be an unhealthy rigidity in the result. Some minds are naturally inelastic. That class of mind that Roger Ascham calls *harde wittes* is inclined to be unduly rigid. Great care must accordingly be taken that the true combination is made to start with; and further, continual exercise should be given in dealing with the same ideas in different connections. Exercises of all kinds are useful in this way. Every time that a nurse or teacher is able to satisfy the reproach that is implied in the childish sentence beginning, "You said so-and-so," that nurse or teacher is loosening the too rigid bonds that unite ideas.

But, after all, *harde wittes* form capital material for the teacher, and it is not difficult to discover that Roger has a warm side to this class of pupil. Every teacher dislikes those pupils that have the second kind of mental background, which for want of a better name we may call the *fluid*. Here there is no fear of too close a connection among the ideas; they are allowed to roll about in the mind pretty much as the molecules of a liquid mingle with each other. Some combinations, of course, must be maintained, else the mind would fall to pieces altogether. But all combinations may be easily broken up; to the child one combination is as good as another. Even here we must try to make the mind do its own combining and building up. No doubt we shall have to use stronger inducements, and we must find better and firmer bonds. Above all, we must repeat all those impressions that fix the connection. Instead of seeking for exercises that shall exhibit the ideas in different relations, we must confine ourselves to those that illustrate the same relation in different aspects. The combination must be made by the mind of the pupil; but once made, it may be greatly strengthened by the outside influence of the teacher.

The third class of mind, as characterised by its backgrounds, is the desirable one that may be named the *plastic*. This mind forms its own combinations with fair ease, and at the same time is able to retain them in that state that prevents deliquescence on the one hand, and rigidity on the other.

Coming now to the mechanism of the backgrounds as a whole, we may again classify them as three—these three corresponding to the three kinds we have just dealt with.

The first class may be named the *fixed*. Naturally, no background can be really permanently fixed, except in the case of the insane. In that form of insanity marked by what is known as the *idée fixe*, we have the extreme example of the fixed background. But in ordinary life we find modified forms of the same weakness. Of all the stock figures used by the average leader-writer the most worn and threadbare is a certain reference to King Charles's head. The newspapers find, it appears, that there is such a large class of humanity that have fixed backgrounds, that it is necessary to make constant use of Mr. Dick as an illustration. Your dull matter-of-fact man regards all things against the same unvarying background. He finds the greatest difficulty in knowing what nimbler witted people mean. The same ideas are presented to him and to them. He cannot understand why they produce such a different effect in the two cases.

The second class of mind fails in exactly the opposite way. These minds may be called *unstable*. The fixed background is a characteristic in general of mature life. The unstable background is common in school. The necessity of childhood to grow as well as to live makes it imperative that material should be got from all parts. Accordingly, it is an arrangement of nature that children should be restless in body so as to secure an all-round physical development, and restless in spirit in order that they may derive mental materials from all their environment. A child may have a more or less strong tendency to develop fixed backgrounds, but at early stages it is very unusual to find this tendency strongly marked. Our great difficulty is the instability that characterises the childish background. We are never quite sure that the ideas of this minute will be projected against the same background as the ideas of last. Among grown-up people those who are silly, giggling, flippant are usually those with unstable backgrounds. What is often called the associative mind is of this class. One thing recalls another by mere force of association. A word is enough to divert the current of the stream of thought. Dame Quickly is the stock example of a mind of this sort, though, unfortunately, we do not need to go so far back for abundant examples of the type. The background against which the ideas of Dame Quickly project themselves can hardly be called stable. It is more like a rapidly-moving panorama than an ordinary picture.

(*To be continued.*)

THE MOSELY EDUCATIONAL COMMISSION REPORTS.

MR. A. MOSELY has an undeniable claim to the gratitude of the nation, and may certainly rely on receiving from the large and increasing army of workers in every branch of education unstinted praise and thanks.

Origin of the Commission. When in South Africa, some fifteen years ago, he was very much struck with the ability and success of several American engineers, who practically made possible the development of South African mining enterprise, with its subsequent prosperity. This turned his attention to the

United States, and led to a visit of several months' duration, spent largely in investigation of the resources and possibilities of the States, and the far from negligible influence they were bound to exercise on the industries of the United Kingdom. As far as could be ascertained during this visit, Mr. Mosely came to the conclusion that the form of education given in the States was responsible for much of its success, and he returned home determined, if possible, to get together a party of experts to visit the country and test the soundness of his conclusions. Hence the Industrial Commission of 1902, and the Educational Commission of 1903–4.

Subjects for Investigation. The Commission was asked to investigate :—

1. The development of individuality in the primary schools.

2. The social and intellectual effects of the wide distribution of secondary education.

3. The effect of specific instruction given (*a*) in business methods, (*b*) in applied science.

4. The present state of opinion as to the value of professional and technical instruction of university rank designed with special reference to the tasks of business life.

An eminently practical investigation, and likely to prove most helpful and beneficial at the present time to our new education authorities. The success of the Commission was guaranteed from the beginning, owing to the representative character and educational standing of the commissioners. University education had its representatives in Professor Rhys, Professor Reichel, and Professor Gregory Foster. Secondary education was represented by W. C. Fletcher, Esq., and Rev. Dr. Gray; technical education by Professor Ayrton, Professor Maclean, and Professor Ripper; medical education by Dr. Bradford and Professor Gaskell; legal education by W. P. Groser, Esq.; primary education on its practical side by H. Coward, Esq.; while specialists like Professor Armstrong, and administrators from the various important county councils and educational committees, including A. J. Shepheard, Esq., C. Rowley, Esq., Rev. A. W. Jephson, A. Anderton, Esq., and A. W. Black, Esq., made up a very powerful Commission.

Personnel of Commission.

Method of Investigation. The task of the commissioners was rendered comparatively easy because of the splendidly organised arrangements undertaken by President Butler of Columbia University. The whole tour was mapped out, and at each place visited committees were appointed to show all there was to be seen. These committees consisted of from six to twelve gentlemen, representing various phases of education, so that the commissioners were able to separate into groups and to visit the institutions in which they were more specially interested. In every city banquets were arranged, and the leading educationists invited to meet and exchange views with the delegates. In this way the chief cities in the Eastern States were visited, including Washington, and a reception by President Roosevelt; and the Commission finally dissolved at Chicago, some members being dispatched on special missions as far west as California, others going north and north-west, some into Canada, while the others returned east, visiting many large centres on the way.

Publication of Results. The conclusions arrived at are embodied in a volume of 400 pages, consisting of a preface, which summarises Mr. Mosely's opinions; a short joint report, giving but a faint indication of the individual opinions; and detailed reports from each commissioner, of varying length and importance. Of course there is some considerable divergence of view shown in the separate reports, but from most of them many valuable lessons may be learned. It must not be forgotten that the idea of the commissioners was not to discover and criticise the weaknesses of the American system of education, but to find out its good points, for the benefit of this country. Professor Armstrong is, as usual, quite decided that education in the States, as in this country, is utterly wrong, and stands in need of regeneration; but since he is so well known as an extremist, his report, duly discounted, may be read with much profit. The value of the book would be very much increased by a good detailed index making ready reference easy. As it is intended to spread it broadcast, is it too much to hope that something may be done in this direction ?

General Conclusions. The commissioners were deeply impressed by the evidence they obtained in the United States of the absolute belief in the value of education both to the community at large and to agriculture, commerce, manufactures, and the service of the state. Although in the past the belief in education has been the effect rather than the cause of American prosperity, during the last quarter of a century education has had a powerful and far-reaching influence; and it cannot be doubted that in the future it will become more and more the cause of industrial and commercial progress and of national well-being. They are satisfied that, in years to come, in competing with American commerce we shall be called upon to face trained men, gifted with both enterprise and knowledge. They desire to impress on the British public the absolute need of immediate preparation on our part to meet such competition.

1. American Belief in Education.

They were much impressed with the spirit animating both teachers and pupils, and by the manner in which the two co-operate in the schools and colleges. Teachers are possessed of but one wish—that of helping their scholars in every possible way; while the latter are possessed of a willing if not overwhelming desire to learn. The work of the schools is much facilitated by the absence of class prejudices and of all "religious difficulty."

2. Teachers and Pupils.

3. Theory and Practice. The closest connection is being established between theory and practice, the practical bent of the men of letters and science, and the breadth of their outlook being very remarkable. The services of experts in various branches of knowledge are, therefore, held in high esteem, and are in constant demand.

4. Manual Training. The important part which manual training is beginning to assume in the schools struck them very forcibly. Such work appears to be in many ways of high value as an educational discipline, especially in developing handiness and alertness, and in familiarising the scholars with constructive processes.

5. Liberality of Contributions. They were much impressed by the liberality displayed, not only by the public, but also by private donors, on behalf of education, as evidenced by the wealth of provision in the form of buildings and equipment which is everywhere made. On the other hand, they observe that the remuneration of teachers is by no means always placed on a satisfactory basis; and

they view somewhat with alarm the growing preponderance of women teachers.

6. Co-ordination. Lastly, they draw attention to the extent to which the work of education is organised, and its various grades co-ordinated, whereby harmonious working is secured, and overlapping avoided. The need of effecting such organisation in this country, which was before apparent, now seems imperative, in view of the experience gained in the United States.

American Schools. It will be an advantage to study in detail the various grades of school found in the States. They may be divided into two main classes—those which provide a general education, and those which are devoted to strictly technical training.

1. Common Schools. In the first class we find the elementary schools, free and compulsory to the age of fourteen, equipped for teaching purposes with every appliance that money can supply, conducted with great spirit and enthusiasm, though in many cases under great difficulties, and aiming generally to form smart, quick-witted, alert business men and women, rather than scholars or thinkers. Professor Ripper, speaking of the large number of alien children attending these schools, says :—

"The training of the common school has a wonderful effect on the foreign children in making loyal American citizens of them, though their presence tends to reduce somewhat the standard of efficiency reached by the school as a whole. It has been said of the American common school that it has done more than anything else to make the American nation, and to weld the many and diverse types and interests of which it is composed into one contented and loyal people."

The children of rich and poor alike sit side by side, and thus a freedom of intercourse and community of interest, engendering mutual respect, and lasting far on into life, is set up. The curricula include a wide range of subjects, manual training being prominent in many of them. The majority of the teachers are women, men having so many other careers open to them that they do not enter the profession in large numbers. The salaries of the women teachers range from £100 to £500, and are by no means excessive, the work taxing their energies to the full, and the complaint of undue strain being common among them. In these schools the co-education of the sexes is practically universal.

2. High Schools. Professor Armstrong thinks that some of our higher-grade elementary schools represent in many respects the British equivalent of these schools. These schools are also free, but not compulsory, and are attended by pupils of both sexes from fourteen to eighteen. There is much difference of opinion among the commissioners respecting the work and success of these institutions, but general agreement on the lavish provision made. The city High Schools are prominent everywhere, are architecturally fine structures, and internally well fitted and equipped with all modern requirements. It is therefore not surprising to read that the Central High School of Philadelphia cost £300,000. These schools carry the education of those able to continue in them through courses of classics, mathematics, science, and modern literature, to the college entrance examination. On leaving the High School the student must make his selection from one of four courses — (1) he may go direct to business ; (2) he may proceed to a college for a four years' course of training in the subjects of a general literary education, and then go to business ; (3) he may omit the college course and proceed direct to a professional or technical school ; (4) he may take the college course, and afterwards a course in the professional schools of the universities.

3. Colleges. The American college is an institution which carries on through a four years' course the work of the under-graduate courses of our universities, and is intended to equip the student with such general culture and accomplishment as shall place him in the rank of educated men. Most colleges hold a charter from the state in which they are established, empowering them to confer the Bachelor's degree. They differ widely in efficiency, and the value of the degree depends on the established character of the institution which confers it.

4. Universities. It is somewhat difficult to accurately distinguish the "university" from the "college," as many of them have undergraduate courses, and are therefore colleges as well as universities. The ideal conception would seem to be an institution in which higher studies, literary and scientific, are carried on by students who have already received a college degree. Johns Hopkins University, Baltimore, is the only one approaching this ideal, the others having undergraduate courses similar to the colleges. They offer a wide range of the most varied subjects from which the undergraduate may select his course of study, and they thus make it fairly easy to obtain a degree. In the sphere of specialised studies the universities keep themselves in touch with the industries of the country. In addition to the usual faculties of arts, medicine, and law, they maintain schools of the practical arts, such as pedagogy, pharmacy, engineering, architecture, the mechanical arts, agriculture, and forestry. Besides furnishing trained teachers in these branches, they prosecute research work, and thus put the best thought of the country at the service of its industries, and so furnish a model which our newer university institutions might copy with advantage.

Technical Colleges. In the second division of educational institutions, we find the very important technical colleges. From statistics prepared in 1900, we read of 89 of these institutions, giving instruction to 10,000 students, all over eighteen years, and providing a four years' course. The curriculum consists of about ten per cent. English and modern foreign languages, thirty to forty per cent. pure science and technical drawing, and fifty to sixty per cent. technical subjects. The fees vary from £6 to £7 a year in the state colleges, to £50 a year in such institutions as the Massachusetts Institute of Technology. Again, the most noticeable features of the technical institutions visited were the extent of the laboratories, and the magnificence of their equipment in mechanical, electrical, and physical appliances, the liberal scale upon which these departments were staffed with men of distinction in their various departments of study, and the large numbers of students of an older type than it is usual to see in our own country.

Mr. Mosely's Impressions. Coming to the consideration of individual reports, it is interesting to note the introductory summary of the result of the Commission, given by the originator, particularly as he does not pose as an educationist. He quotes a remark made by President Roosevelt during the reception of the commissioners at Washington, to the effect

that, in his belief, while education could not make a country, the nation that neglected to educate its people would be assuredly undone in the long-run. He remarks on the large amount of money devoted to educational purposes, and contrasts the practical character of American teaching with the classical tendency of our own. American boys remain at school much longer than is the case here, passing through the schools and colleges at little or no expense to their parents or themselves. On leaving school a boy is infinitely better fitted for his vocation and struggle in life than the English boy, and in consequence there are fewer "failures" in the States than here. The true-born American does not become a drag upon his fellows, but takes his place as a respectable citizen, earning his living soberly and honestly.

The types of men developed by the educational methods of America appear to be entirely different from what we produce at home. President Murray Butler, for instance, is not only a man of great learning and high academic attainments, but possesses the initiative and organising capacity that are required in a railroad president or chairman. Many other instances are given of alert, up-to-date, organising men, who possess excellent business qualifications in addition to their academic learning. Again, the Americans regard the money spent on education as a magnificent investment for their country, and it is quite a hobby with moneyed people to devote enormous sums to the endowment and equipment of various educational agencies. He quotes the saying that in America there is no aristocracy but that of money, and suggests that in reality this means an aristocracy of brains, since few of the people have as yet inherited riches, and their remarkable success must therefore be due to their exceptional ability and brain power.

In a more critical mood, he does not regard altogether favourably the preponderance of women teachers over men. Although for young children women may be preferable, he would turn pupils over twelve years of age to the charge of men, making the salaries of the latter sufficiently attractive to obtain the necessary teachers. The neglect of musical talent among the school children was also a matter of regret, seeing how music makes for a bright and happy home, and tends to raise the standard of life from an idealistic point of view. The question of sports in American schools as compared with those of this country is also dealt with, to the disadvantage of the latter. Finally he says :—

"Looking into the future of our own country, I feel bound to record my belief that the régime of the past, however successful it may have been, is obsolete. Honesty, doggedness, pluck, and many other good qualities possessed by Britons, though valuable in themselves, are useless to-day unless accompanied by practical, up-to-date scientific knowledge; and such knowledge only becomes possible with an enlarged and enlightened system of education. I am an intense believer in the ability and stability of the Briton, but he cannot successfully face the competition of the world with the obsolete weapons now at his command. The warning of the Prince of Wales came none too soon: if we wish to hold our own in the world's race, we must indeed 'wake up.' We have magnificent material—it remains with the nation at large to decide whether or not it shall be properly utilised."

The report is to be on sale at the Co-operative Printing Society, Tudor Street, E.C., price one shilling; but members of any educational authority, or local manager, or teacher, may obtain a copy free by paying postage and stating qualifications.

Next month we shall deal with the more important points raised by the various experts in their individual reports.

REPORT ON ELEMENTARY EDUCATION IN IRELAND.

THE Report before us deals in an exhaustive manner with the Irish primary schools, with particular reference to premises, equipment, staffing, and instruction given. Unfortunately primary education has been sadly neglected in Ireland, it evidently never having occurred to the political saviours of that distressed country to include education among the various panaceas that have been put forward from time to time for healing her wounds and shedding happiness and prosperity throughout the land.

Eighty-seven national schools and eight large convent schools were visited. These were situated in all parts of the country, so that it was possible to differentiate those features which were common to all schools from those which were due to the particular standard of education in the locality in which the school was situated.

Dealing first with the premises of town schools, we find the most common defect is the insufficiency of classrooms. In the ordinary schools in Dublin and Belfast the great majority of the scholars are taught in a single large room, 50 feet or more in length, and 25 to 40 feet in breadth, and the minimum floor-space allowed per child is usually 8 square feet. The classrooms themselves are not only insufficient in number, but are frequently too small for a class of ordinary size. As the class cannot be divided without impairing the organisation and instruction, the classrooms are overcrowded. For example, in the Belfast schools over thirty children were frequently found in a room which even at eight square feet per child would accommodate only eighteen. Neither the cleaning nor the maintenance of the school buildings in a state of good repair receive such careful attention as in England, and it is not uncommon to find dingy walls or ceilings, broken woodwork or plaster, and dirty floors. In respect of their provision for cloakrooms and lavatories, Irish schools are decidedly inferior to the English. In large and important schools the caps and cloaks are often hung in the schoolroom, and the only substitute for a lavatory is a tap in the corner, with sloppy surroundings. These remarks apply to many of the best schools, but, says the Report, "It is difficult to give in words any adequate conception of the buildings which are classified by the Irish inspectors as bad." The premises of the country schools are as a whole much more satisfactory than those of the town schools; the most marked defect in schools otherwise satisfactory is the want of cleanliness—the floors are generally dirty, the walls and cupboards are often covered with dust, and small repairs to windows, floors, and doors are generally neglected.

On the cause of the inferiority of Irish school buildings the Report speaks with no uncertain note. First and foremost is placed the false economy shown on the part of the authorities. Thus, according to the estimate of the Senior Surveyor of the Irish Board of Works, a primary school for 91 children, built according to the regulations of the English Board of Education, would

cost £819; if, however, it were built according to the existing Irish rules, it would cost only £381, and would be regarded as accommodating 120 children. The folly of this so-called economy is a point that the new authorities in this country would do well to lay to heart. The charge of extravagance in their buildings was often levelled against the English School Boards; but what possible economy can there be in crowding children together as in the Irish school, so "that even to maintain order under such conditions requires considerable skill on the part of the teachers, while instruction in such subjects as reading or singing is almost an impossibility"? Another cause of inferior premises is the absence of a local authority charged, like the English local authorities, with the duty of aiding the provision and maintenance of the school buildings in its area. This leads to inordinate delay in superseding insanitary buildings, or in coping with the need for additional school accommodation. For example, the North Thomas Street School, Belfast, was reported as unsuitable by the inspector in 1874, yet it is still in use.

With regard to the equipment of the schools, the point that strikes a visitor most is the insufficiency of desks; for, under the Irish Code, desks need only be provided for a proportion of the children. This, however, is not found to be a very serious disadvantage; in fact, the Report recommends that it would be better to improve the quality of the existing desks before taking any steps to increase their number.

The reading-books and other school necessaries have to be purchased by the children themselves, but even in the poorest parts the parents have no objection to making these payments.

Passing to the subject of staffing, we find that the teachers are divided into four classes, each class having a close though not an exact counterpart in England:—

(1.) Certificated teachers who have been trained for one or two years.

(2.) Certificated teachers who have not entered college.

(3.) Manual instructors and teachers of needlework.

(4.) Paid monitors.

With regard to salaries, it is rather difficult to compare those paid in Ireland with salaries in this country, but an approximate calculation points to the conclusion that the salaries of men teachers in Ireland are quite on a level with those paid to men teachers in English country schools, while the salaries of women teachers in Ireland tend to be distinctly higher than those of women teachers in England. This is encouraging; but we must not overlook the point to which attention is drawn in another part of the Report, that the expense of providing new maps and apparatus, or even of school-cleaning, is often defrayed by the teacher.

Turning to the matter of attendance, it is rather surprising to find that although in the large towns attendance is now compulsory, it is still optional in many parts of the country. Even in the towns attendance is extremely irregular. In Belfast, for instance, in 1902 the average daily attendance was only 72 per cent. of the number on the rolls, whilst in the rural districts it falls as low as 55 per cent.

The section dealing with the curriculum and methods of instruction in Irish schools comes at a particularly opportune moment, since we find a tendency in London and elsewhere to revert to the old system of individual examination and payment by results. For the benefit of those educational Jeremiahs who are continually lamenting the falling off in accuracy since the abolition of individual examination, we quote the following paragraph:—"The instruction in ordinary Irish schools compares favourably with that of similar English schools in point of accuracy, but very unfavourably in point of intelligence of method and aim. For this difference, the longer continuance in Ireland of the system of 'payment by results' and the narrowness of the curriculum prior to 1900 are chiefly responsible. It was clearly not to be expected that teachers, whose salaries depended on bringing every child up to the standard of mechanical accuracy required, would display any initiative in going outside the terms of the syllabus—would, for example, introduce composition or mental arithmetic at an earlier stage than was prescribed, or allow children who had read one book through to proceed to a new one. On the contrary, such initiative might have endangered the grant; and, therefore, the natural procedure was to allow the clever children who were certain to pass the examination to mark time and idle, while, by means of the draft system, the backward children were brought up to the necessary standard." The evil of this draft system—that is, the plan of sending off a few backward children in charge of a monitor or assistant teacher—is seen also in the teachers themselves. "The fact of the teacher's attention having been confined always to a few children necessarily tends to make him lose sight of all children except those immediately under his eye."

Dealing with the various subjects of instruction, we find the reading in Irish schools is quite as fluent and correct as in the English; but owing to the draft system, the children, being so near the teacher, are not forced to speak clearly, and the reading often degenerates into a monotonous mumble. The habit, too, of going over each paragraph again and again until every child can read it, prevents the scholars from getting any general idea of the piece as a whole, or from regarding reading as a means of obtaining information. Similarly, the handwriting is quick and legible, and, on the whole, better than in the English schools; and the spelling is more accurate, especially among the younger Irish children; but how absolutely disconnected the teaching of writing and spelling has been from its proper end in composition is seen from the following example. In a country school the older boys were copying the following well-known passage from their reader: "The brain of a true Caledonian, if I am not mistaken, is constituted on quite a different plan. His Minerva is born in panoply." The beginning of a simple letter, written by these boys, was as follows:—

"Sir,

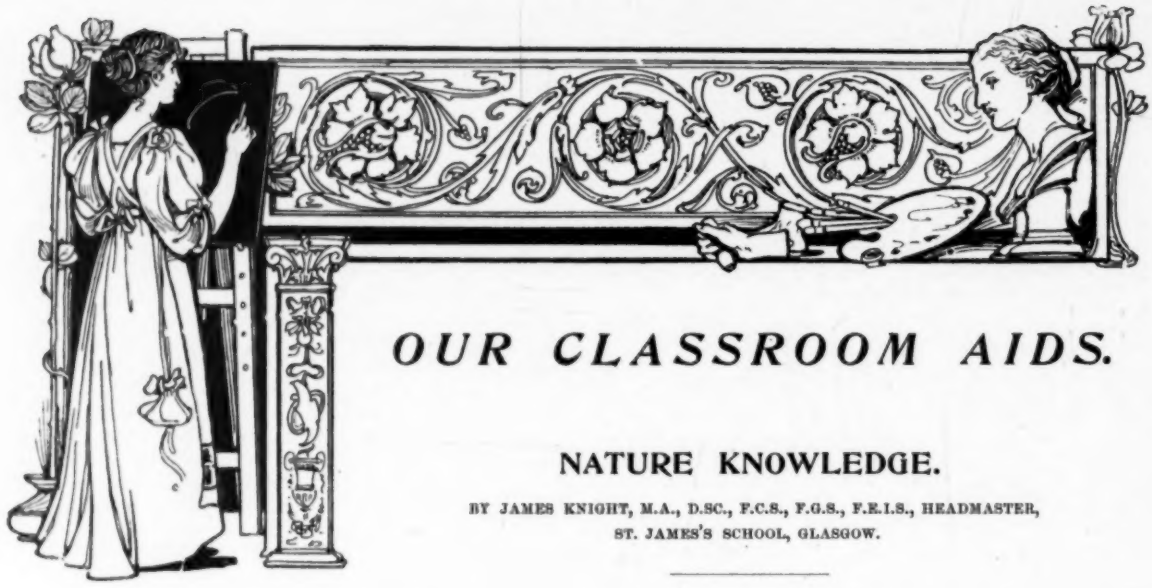
"I spent yesterday with the greatest of pleasure. The first thing that I done was to eat my breakfast."

Or, to take another extract:—

"Dear Sir,

"I spent yesterday in the folling way. First by going mass, and when I came home and eat my breakfast."

One reason for this weakness in composition lies in the fact that the Irish teachers seldom encourage the children, when answering in the ordinary lessons, to cultivate the power of suitable expression; in fact, as a rule, little or no notice is taken of incomplete or ungrammatical answers. In arithmetic the Irish children are much quicker than the English at working correctly long sums by rule on paper or slates, but, unfortunately, this mechanical accuracy has been gained largely at the expense of intelligence.



OUR CLASSROOM AIDS.

NATURE KNOWLEDGE.

BY JAMES KNIGHT, M.A., D.SC., F.C.S., F.G.S., F.E.I.S., HEADMASTER, ST. JAMES'S SCHOOL, GLASGOW.

LESSONS ON FOODS: SALTS.

BY the term "salts" here is meant what is sometimes called mineral matter, inorganic matter, or "ash"—that is to say, the residue obtained when a sample of food is burned away as far as possible in an open fire. Take a piece of oatcake, powder it down, and heat gently in a small porcelain basin over a bunsen flame. At first steam appears, showing that oatcake contains water; then the substance darkens in colour, finally assuming the black aspect of charcoal—a proof that oatcake contains carbon. If now the heat be increased, the whole of this black mass may be burned off, leaving a small white residue, the so-called "ash," consisting of various metallic compounds, chiefly oxides, sulphates, and other compounds not easily broken up by heat. It is to be borne in mind, however, that these substances are to a certain extent artificial, and owe their precise form to the method of analysis which has been employed. For instance, lime (calcium oxide) is regularly found in the ash of milk; but it must not be supposed that lime exists as such in milk. Some calcium compounds indeed exist, but these have been converted into lime by the process of ignition. Again, phosphates and sulphates often occur in ash; but these simply represent the end oxidation-products of phosphorus and sulphur present in the original sample in some form or other. To give phosphates or sulphates to a patient deficient in the elements named would therefore be like feeding a fire with ashes, since phosphates and sulphates have already been oxidised—that is to say, burned to their fullest capacity. What is given is, as nearly as possible, the raw elements; but in the cases quoted phosphorus is a poison and sulphur not readily digested, and so the next best thing is to give these elements combined with as little oxygen as possible, say as hypophosphites.

The question as to the presence and uses of the inorganic matters found in food is best answered by considering the part which these substances play in the tissues of the body, and the following tables give a bird's-eye view of their distribution in representative organs. The tables show separately the percentage composition of the ash obtained from the chief solid and fluid parts of the body.

SOLID TISSUES.

	Bone.	Muscle.	Brain.	Liver.	Lungs.	Spleen.
Sodium chloride	—	10·59	4·74	—	13·0	—
Soda	—	2·35	10·69	14 51	19·5	44·33
Potash	—	34·40	34·42	25·23	1·3	9·60
Lime	37·58	1·99	0·72	3·61	1·9	7·48
Magnesia	1·22	1·45	1·23	0·20	1·9	0·49
Ferric Oxide	—	—	—	2·74	3·2	7·28
Chlorine	—	—	—	2·58	—	0·54
Fluorine	1·66	—	—	—	—	—
Phosphoric Acid	53·31	48·13	48·17	50·18	48 5	27 10
Sulphuric Acid	—	—	0·75	0·92	1·4	2·54
Carbonic Acid	5·47	—	—	—	—	—
Silicic Acid	—	0·81	0·12	0·27	—	0·17

BODY FLUIDS.

	Blood.	Blood Serum.	Blood Clot.	Lymph.	Urine.	Milk.	Bile.	Faces.
Sodium chloride	58·81	72·88	17·36	74·48	67·26	10·73	27·70	4·33
Potassium do.	—	—	29 87	—	—	26·33	—	—
Soda	4·15	12·93	3·55	10·35	1·33	—	36·73	5·07
Potash	11·97	2·95	22·36	3·25	13·64	21·44	4·80	6·10
Lime	1·76	2·28	2·58	0·97	1·15	18·78	1·43	26·40
Magnesia	1·12	0·27	0·53	0 26	1·34	0·87	0·53	10·54
Ferric Oxide	8·37	0·26	10·43	0·05	—	0·10	0·23	2·50
Phosphoric Acid	10·23	1·73	10·64	1·09	11·21	19·00	10·45	36·03
Sulphuric Acid	1·67	2·10	0·09	—	—	2·64	6·39	—
Carbonic Acid	1·19	4·40	2·17	8·20	—	—	11·26	—
Silicic Acid	—	0·29	0 42	0·42	4·06	—	0·36	3·13

Looking generally at these tables, it will at once be seen that the solid tissues of the body are rich in potash and phosphorus compounds, while the bodily fluids are characterised by the presence of soda and chlorides. A notable exception is given by the liver and spleen, which contain a great deal of soda, while among the fluids milk shows an excess of potash; both sets of discrepancies are explained by the peculiar functions of the tissues concerned. A comparison of the salts in blood serum and clot respectively fetches out this broad distinction very well.

Looking again at the first table, we find that bones show a large percentage of lime and phosphorus—practically phosphate of lime, or bone-ash. This is by far the most abundant salt in the body, being three-quarters of the total mineral matter, and constituting one-half of the weight of bone. It is also found in the dentine and enamel of the teeth, substances resembling bone, but harder. Now all our supplies of lime and phosphorus come from food, and it is interesting to turn in

this connection to the analysis of milk, the typical food for a young, rapidly-growing infant, and from this analysis it at once appears that the natural demand for lime and phosphorus may be met by milk alone, without such extraneous aids as lime-water and whole wheaten meal.

The phosphates of soda and potash give an alkaline reaction to most of the bodily fluids, and the alkaline reaction of blood is also partly due to these substances, which are chiefly derived from food. The carbonates of soda also assist in keeping the blood alkaline, and one very important source of these is the vegetable acids, oxalic, citric, tartaric, acetic—all of which are broken up in the course of digestion to form alkaline carbonates of soda and potash. This explains the seeming contradiction of taking such a highly acid fruit as lemon to remove acidity in the blood, as in rheumatism and gout.

Common salt (sodium chloride) is found in all tissues and fluids. The body contains about 200 grams, say ¾ oz., and about 16 grams are excreted in the twenty-four hours, chiefly in urine, as the table shows, though small quantities are also removed in sweat and fæces. Gastric juice contains free hydrochloric acid, so that the supply of chlorides becomes a necessity if gastric digestion is to be carried on. Besides this use, salt is necessary for dissolving globulins, albuminous bodies which do not dissolve in water; and it further plays an important part in promoting diffusion of the digestive products through animal membrane.

Special interest attaches to iron, which in the table appears as ferric oxide. Its presence in the lungs is due chiefly to the blood which it is impossible to remove; but it bulks very largely in liver and spleen, more especially the latter, a circumstance which throws some light upon the functions as a "blood gland" of that somewhat obscure organ. Among liquids, the blood has almost a monopoly of iron, and this is confined practically to the clot, and even more narrowly to hæmoglobin in the red blood corpuscles. This is a very important substance, inasmuch as it acts as oxygen carrier from the lungs to the remotest tissues, and so maintains that internal respiration which produces animal heat. There are only 3 grams, or 46 grains, of iron in the whole body, a fact worth considering in view of the wholesale consumption of Blaud's pills by degenerate females.

It is interesting to note the large percentage of phosphorus in nervous tissue, taking the brain as a sample, and further interesting to see that phosphorus waste leaves the body chiefly in urine. The popular notion of fish being a brain food is thus superficially correct, though probably the argument goes no further than the surface. Fish is a food highly nutritious and easily digested, and is therefore of value to persons of sedentary habits, a factor which may have more to do with brain formation than a mere chemical analysis.

Details of the distribution of these salts may be found in *Food and its Functions*, Lesson 9, while many useful chemical hints are given in Part II. of Abbott and Key's *Progressive Lessons in Science*. A few chemical experiments, suitable for class demonstration, may be given here.

Take a pen point and dissolve it in nitric acid so as to get a brown solution; dilute this with water, and divide it into two parts. To the first portion add one drop of potassium thiocyanate (KCyS), or the similar ammonium salt (AmCyS); this gives a deep but transparent blood-red colour—a very delicate test of the presence of iron. Now take the second portion, and add a few drops of yellow prussiate of potash (K_4FeCy_6); the result is a deep Prussian blue, another certain sign of iron. Now apply these two tests to the detection of iron in blood, vegetables, soil.

Get some blood clot and dry it for some days in an oven till it is quite black and brittle; then powder it, and heat strongly in a thin porcelain basin till all the black colour disappears and nothing but a brownish ash is left. A platinum capsule may be used for this ignition, by getting four square inches of platinum foil and turning up the edges so as to make a shallow tray. This may be placed on a bit of wire gauze and heated red-hot, care being taken not to use tongs or indeed any iron tool whatever when looking for iron. Now take this blood-ash, dissolve it in nitric acid, warm a little, and use either of the iron tests. Cigar-ash makes another good substance for analysis in this way, since tobacco-leaf is rich in iron, and the cigar-ash is already ignited, needing only treatment with nitric acid. The same tests may be applied to green leaves, grass, or hay, taking care not to use a knife or scissors in cutting these. Like blood, these vegetables must be thoroughly dried in an oven, then rubbed down to a powder, and ignited on porcelain or platinum, so as to obtain a pure ash. Soil is easily tested. Take a tablespoonful of loose garden soil, put it into a beaker with nitric acid, and warm gently, stirring all the while. When the acid has thoroughly extracted the soil, pour off the liquid and test as before.

The test for calcium salts is at once simple, pretty, and interesting. Get a piece of marble or limestone—a girl's "peevor" may be borrowed for the occasion—moisten a corner of it with hydrochloric acid, or even vinegar. Notice the effervescence of carbonic acid gas, showing that marble and limestone are carbonates. Now hold the effervescing mass almost touching the flame of a bunsen lamp; the latter is immediately coloured a bright orange-red, the sign of calcium. This test may be repeated with egg-shells, and also with bone-ash. Since this latter is mainly phosphate of lime, it does not effervesce to any great extent with hydrochloric acid, and to get the best flame coloration it is better to dip a clean platinum wire into the acid and then lift up a small amount of bone-ash on the damp wire. It goes without saying that the wire must be carefully cleaned after each experiment.

Soda compounds are also very easily detected by the flame coloration which they produce. Thoroughly clean a piece of platinum wire, dip it into hydrochloric acid, then just touch with it any soda compound, such as common salt or baking-soda. Now hold this just at the bottom of the bunsen flame; the result is an intense golden-yellow tint. This test may be applied to the ash of any foodstuff, since sodium compounds are almost universal—indeed they are so much in evidence as to obscure other flame reactions, like those of calcium and potassium. Clap your hands beside a bunsen flame, and observe the yellow colour imparted by the particles of dust; or knock the bunsen burner on the table to produce the same effect. Carefully clean a piece of platinum wire, so that it simply glows in the flame without colouring it. Now just rub it between the finger and thumb, and once more try the flame test; a yellow coloration follows, due to the surface waste from the skin. Fortunately this constant yellow coloration may be shut out by watching the flame through blue glass; and this precaution is absolutely

necessary in examining crude ash, which may contain a mixture of several compounds.

Take again a clean platinum wire, moisten as before with acid, and lift up a few grains of any potash salt, such as cream of tartar or saltpetre. To the naked eye the flame is coloured lilac, but seen through blue glass the colour is more like crimson. Add a little common salt to the potash, and test again. This time the lilac of the potash is almost completely masked by the powerful soda yellow; but a blue glass screen shuts out this latter, permitting the potash crimson to come more into evidence. Now apply this test to blood or milk ash, to tobacco ash, and to lemon juice.

Many other examples might be given for revealing the presence of inorganic salts in bodily tissues and food stuffs, but these will readily be suggested to chemical students, and for non-chemists Abbott and Key's little book (Blackie, 2s. 6d.), already mentioned, will prove a mine of information. Among the more important substances to be examined, there remain phosphorus, chlorides, carbonates, and sulphur compounds. A simple test for sulphur, applicable in many instances, will suffice here by way of closing sample. Everybody has observed the odour of sulphuretted hydrogen given off by cabbages when being cooked, and most people have observed the same gas to be one of the products of a decomposing egg. Even a fresh egg stains a silver spoon black owing to the formation of sulphide of silver, and this may be made the basis of a test for sulphur. Take a bright silver coin and place on the top of it some egg, either white or yolk, then add a few drops of hydrochloric acid, stirring with a clean glass rod to mix them thoroughly. Allow the mixture to lie on the coin for not less than five minutes, more if possible, and the result is a dark stain of silver sulphide, which may be made almost black with a long contact.

NATURE NOTES FOR THE MONTH.

BY P. HORN.

Notes on Current Plants.

THE fortunate individual who has planned to go butterfly-collecting at Whitsun may experience feelings of disappointment, when he arrives on the scene of action, to find that the extent of his happy hunting-ground has been sadly curtailed. The orchards and pasture lands, which were so productive of interest last month, may now be considered as forbidden ground; for on the approach of haytime it is customary to close the fields, in order that the rapidly-lengthening grass may have opportunity to attain its maximum growth. The collector who has any regard for his own personal dignity will do well to ask permission before invading private property, for nothing annoys the farmer more than to see a stranger making tracks (in the literal sense) through his prospective hay crop. The writer speaks from personal experience, having painful recollections of the capture of his first orange tip.

One of the most conspicuous flowers of the month is the wild hyacinth, or bluebell—not the thin-stemmed harebell (which appears in July), but the fleshy-stalked flower which carpets our woodlands with such a blaze of glorious colour. This plant will grow luxuriantly even in the direct shelter of the trees, a situation which is peculiarly unfavourable to plant life. The bulbs of these woodland-grown flowers are usually buried at some considerable distance beneath the surface of the soil; consequently we find that the bunches of bluebells which the children bring to school consist mainly of stems. The depth at which the bulb lies is easily gauged by the colour of the stalk; for, owing to the absence of light beneath the surface, the underground portion of the stem is almost white when compared with the remainder above the surface. Deep blue is the prevailing tint of the hyacinth, but occasionally a white or purple flower is found.

Quite a host of flowers have lately arrived to reinforce the modest primroses and violets, which still linger beneath the hedges in considerable numbers. The following are almost sure to be seen in the course of an ordinary ramble: periwinkle, cowslip, bugle, anemone (wood), ground ivy (no relation to any other plant of the same name), buttercup, campions both red and white, cardamine, arum, etc.

The last two plants are worthy of notice, for their popular names, "cuckoo-flower" and "cuckoo-pint," will give us some idea of the feelings of interest with which the ancients regarded the return of the migratory birds. We can quite imagine some ingenious individual naming these plants after what he considered to be the most interesting and remarkable event of the month.

On breezy commons the broom and furze are now to be seen in their full glory of green and gold. The latter plant bears its yellow flowers throughout the whole of the year in more or less quantities, but the main body of bloom makes its appearance in the early summer. The furze has a curious method of distributing its seeds—a method which cannot fail to attract the attention of the most diffident of observers. When the fruits are ripe the two halves of the enclosing pod, held at a high state of tension, split asunder with a sharp report, and scatter the seeds around. In the height of a hot summer day, when numbers of the fruits are ripening, the continuous crackling of the pods merges into a veritable fairy fusillade.

The ponds and sluggish streams are rapidly becoming covered with the white blossoms of the water-crowfoot. This plant, which is very suitable for the aquarium, has two distinct sets of leaves growing from the same central stem. Those entirely submerged are filiform or hairlike; on the other hand, the leaves which lie on the surface show a marked tendency to revert to a terrestrial form, doubtless because their functions are similar to those of the leaves which grow on land plants.

"Cuckoo-spit."

In the course of the month a curious frothy substance, resembling spittle, makes its appearance on the low-growing herbage. It is quite a common occurrence to find it in town gardens, clinging in white masses to the leaves of the lilac bushes, particularly on the young growth round the base of the plant. In spite of their unsavoury appearance, there is nothing objectionable about these foam-flecks, for they are simply collections of air bubbles blown from the sap of the plant by a little insect. If a portion of the froth be gently removed, the little worker, a yellowish-green insect with conspicuous black eyes, will be discovered clinging to the central stem, amidst the wreckage of his home. This creature is the young of the common frog-hopper. By means of a sharp beak it pierces the leaf stem and extracts the sap for its own personal nourishment, some

of the liquid food being utilised for the purpose of building the quaint home in which it spends the earlier portion of its existence.

As the young frog-hopper approaches maturity, it undergoes considerable changes, befitting it for a life of activity in the outer world. There is no pupal or quiescent stage, as in the case of the butterfly, but the transformation takes place whilst the insect is sheltering amidst the froth, in full possession of all its faculties. Wings gradually develop from four tubercles situated on the back, the body hardens, and the weakly legs become strengthened into serviceable organs of propulsion. Our hermit, now a fully-developed frog-hopper, finally quits his frothy home, to enter into a new stage of existence.

The adult frog-hopper is doubtless familiar to all as the brown, wedge-shaped insect which rests, head upwards, on the stems of the garden plants. Its wings are not apparent at first sight, being hidden under stout wing-cases, after the fashion of the ladybird and other beetles. If the insect is lightly touched, it exhibits its extraordinary agility by leaping to a distance of six feet—disappearing in a manner which is positively uncanny. Probably the wings are useful in breaking the fall, but the whole operation is carried out with such rapidity that the eye is unable to follow the progress of the insect to its alighting place.

The name "cuckoo-spit" perhaps needs explanation. The observant ancients were greatly puzzled as to the origin of this frothy matter. Noticing that it appeared simultaneously with the return of the migrants, they came to the conclusion that the cuckoo was responsible for the phenomenon. Later on the true cause was discovered, but the old name of "cuckoo-spit" was adhered to, and has been retained until the present day.

The Discriminating Butterfly.

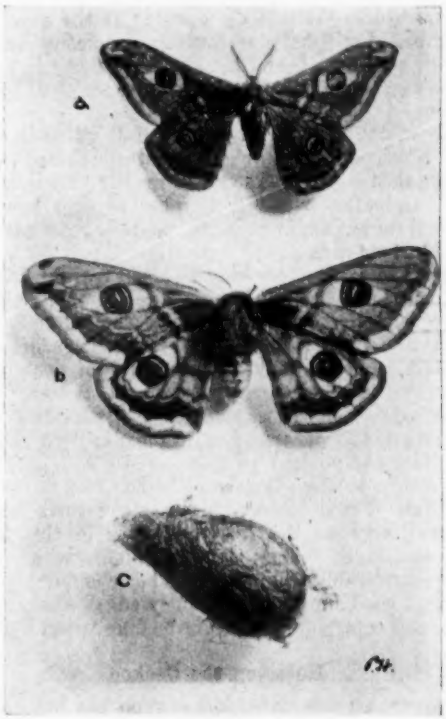
If the weather conditions prove favourable during the present month, the collector should have a busy time with the orange tip, sulphur, small white, large tortoiseshell, and other butterflies.

On warm, sunny days the kitchen garden is almost sure to contain a few specimens of the small white, which flit about the cabbages in a manner which suggests that they are taking an interest in matters agricultural. As a matter of fact, this is exactly what they are doing. The majority of these butterflies are pregnant females, whose sole aim in life is the propagation of their species, and they are visiting the garden with the object of finding a suitable plant for the reception of their eggs. In common with the other Lepidoptera, the mother appears to exercise a great deal of wisdom in carrying out this part of her duty. Newly-hatched caterpillars are notoriously dainty feeders, preferring to starve rather than partake of a plant which is not to their liking; so it is obviously the female's duty to posterity to deposit the eggs in the immediate vicinity of the correct food plant.

With such a variety of plants to choose from, one would naturally imagine that she sometimes makes mistakes, but this supposition is not borne out by actual observation. The old female invariably selects the right food plant. Undoubtedly her highly-organised sense of smell is the means of identification, for if we carefully watch the small white we notice that she hovers over a great number of plants before alighting on the final object of her choice. Possibly the scent from the cabbage-plot awakens the dim memories of her own past life. In this case, motherly instinct would naturally lead her to deposit the eggs on the trusty plant which nourished her during infancy.

As a general rule each variety of butterfly and moth has its own particular food plant. Of course there are exceptions. In its larval state the buff ermine moth, which prefers quantity rather than quality, has gained a bad reputation amongst gardeners owing to the impartial manner in which it feeds. The orange tip haunts the cardamine, the small tortoiseshell flickers round the nettle beds, whilst the death's-head larva, when it *does* condescend to make its appearance, is invariably found on the potato haulms or the tea-plant.

If the particular food plant is rare or local, then the dependent insect exhibits the same peculiarities. The



Emperor Moth.
(*a*) Male. (*b*) Female. (*c*) Cocoon.

wide distribution of the small white may be accounted for by the fact that cabbage and turnips are so extensively cultivated in this country.

The British Silkworm.

Silkworms have a great place in the affections of the small boy, though his affection does not always tend to the benefit of the unfortunate caterpillars. The lad who has not kept these interesting creatures is generally to be distinguished by the hazy ideas which he holds with regard to the stages which all butterflies and moths must necessarily pass through before they are able to issue forth as perfect insects. We frequently find grown-up people who are not quite certain whether the moth changes to a caterpillar or to a chrysalis!

Of late years this lamentable state of ignorance has been dispelled, to some extent, by the exertions of those enthusiastic teachers who make a practice of rearing caterpillars in the classroom. The example selected is

invariably the common Chinese silkworm, which feeds on the leaves of the mulberry.

For the purpose of illustrating the life-history of the Lepidoptera in general, I strongly advise teachers to try some of our native-bred species, which are much more hardy and attractive than the ordinary silkworm. For example, let us briefly consider the good points of the emperor moth, which is emerging this month.

In the first place, this beautiful creature is the sole British representative of a numerous family of silk-moths which extends practically round the whole of the world. The caterpillars are attractive in appearance, cleanly, hardy, and easily reared on heath or apple leaves. They are veritable silkworms, and the cocoons which they spin, though not so highly coloured as those of the ordinary silkworm, possess a very interesting feature. Within the opening at the smaller end a number of stiff hairs are arranged, pointing outwards in such a manner that they allow the moth to emerge, at the same time preventing the entrance of undesirable visitors.

The moth itself is most beautiful, particularly the male, which exhibits the characteristic feathered antennæ in a marked degree. The sexes readily pair in confinement, and after a goodly number of eggs have been reserved for the coming season, the remainder can easily be sold in order to defray expenses.

The most satisfactory way to begin rearing this moth is to purchase the *fertile* eggs direct from one of the reputable dealers who advertise in the columns of the *Bazaar* and *Nature Study*. The latter magazine, which is issued monthly, makes a speciality of dealing with the subject of "Nature Study in the School," many of the articles being written expressly for the benefit of teachers and others upon whom devolves the duty of training the young.

To return to the silkworm—the common or ordinary silkworm. These interesting little creatures may be expected between the 18th and 25th of this month. They should be fed on chopped mulberry or lettuce leaves—preferably mulberry. The chopping process ensures a good supply of soft, juicy edges, thus enabling the young caterpillars to begin feeding without further delay.

Notes on the Cuckoo.

From time immemorial the cuckoo has been a most interesting and potent factor in building up the folk lore of the country. We have already had instances of this in the "cuckoo-spit" and "cuckoo-flower."

Old writers have gravely informed us that this bird was transformed into a hawk on the approach of winter, again resuming its former condition when spring returned. A hundred years ago many people firmly believed that the cuckoo crept into hollow trees and crannies of the rocks, to pass the winter in a state of hibernation. The latter idea is not quite so preposterous as it appears at first sight, for the hedgehog and the dormouse—animals far higher in the scale of creation than the cuckoo—sleep soundly for five months of the year, without taking any form of nourishment. Of late years, however, scientists have proved beyond dispute that this bird winters in Africa. Both sexes arrive here in April, and immediately proceed to distribute themselves over the whole of Britain.

The familiar note, one of the most characteristic sounds of our English spring, is the love-song of the male, and is occasionally uttered whilst the bird is in full flight. When pursued by several ardent males, the female expresses her indignation by giving vent to a harsh gurgling cry, which immediately has the effect of provoking her suitors to a further outburst of melody.

As most people are aware, the female cuckoo deposits her eggs singly in the nests of smaller birds, notably those of the hedge-sparrow (not a "sparrow," by the way), the pipit, and the wagtail.

Two interesting facts may be noticed in connection with the egg. In the first place, it is remarkable for its abnormally small size. If the egg were proportionate to the bulk of the parent, it should be at least equal in size to that produced by the domestic pigeon; whereas the cuckoo's egg is barely larger than that of the sparrow. Again, the eggs laid by different females are not always alike, as regards the ground colour and distribution of markings. So great is the range of colour variation that competent naturalists have put forward the theory that the eggs of the cuckoo are specially designed for the purpose of imitating those of its dupe.

After ejecting his foster-brothers in the familiar way, the young cuckoo receives the individual attention of both of the old victims, and as a consequence we soon find him sitting *on* the nest, rather than *in* it—in fact, this neat structure is flattened out of all semblance to its former shape. One such nest, a hedge-sparrow's, which I examined last August, was thickly powdered with the disintegrated coverings cast from the young feathers.

The old cuckoo, by foisting her household cares on to the unlucky dupe, is able to leave us by the end of July; but the young (distinguishable by its paler plumage) sometimes lingers till the end of September.

South London residents who wish to hear the nightingale's song should make a point of visiting Putney Heath, particularly that portion which fringes the cemetery on the Portsmouth and Kingston Road.

PRACTICAL HELP IN THE ARITHMETIC LESSON.

BY GEORGE COLLAR, B.A., B.SC.,
Joint Author of "A New Arithmetic."

BEFORE dealing with vulgar fractions it is usual to devote some time to that part of the theory of numbers which is concerned with factors and multiples. The teacher will have no difficulty in showing the class that all numbers can be formed by multiplying two numbers together—for example, $12 = 3 \times 4$, $21 = 3 \times 7$, $11 = 1 \times 11$, $23 = 1 \times 23$—but that in some cases both numbers are different from the number obtained, while in other cases one of them is the same. The numbers which when multiplied together make up the given number are called its **factors** (from a Latin word meaning "to make"). Some numbers can be formed in several different ways—for example, $12 = 1 \times 12 = 2 \times 6 = 3 \times 4$: such numbers are called *composite numbers*. Others cannot be formed except by taking the number itself as one factor and 1 as the other: these numbers are called *prime numbers* or *primes*. Among composite numbers it is worth while to call attention to a certain special class which is comprised of those numbers which can be formed by repeating the same factor. These numbers are called *powers* of the factor repeated, and the factor is called

the *root* of the number. Much misconception is cleared away if powers and roots are presented to the children simply as particular cases of multiples and factors. Children will not be so likely to make such incorrect statements as, "The cube of a number is the number multiplied by itself three times." If we take a number such as 2 and multiply it by itself three times, we obtain $2 \times 2 \times 2 \times 2 = 16$, which is the fourth power of 2, and not its cube.

Exercises should be given first on multiples in general. For example :—

Give three multiples of 2.

Give two multiples of 17.

Give all the multiples of 12 that are less than 100. (Of course 12 itself is the lowest multiple of 12.)

Give all the multiples of 21 which lie between 100 and 200.

Then should come exercises on powers, the names applied to the different powers having been first explained—thus the square, cube, fourth power, fifth power, etc., are formed by taking the given factor two, three, four, five times respectively.

Give the square of each number up to 12.

Give the cube of each number up to 10. (These should be found mentally.)

Give the square of 17, 25, 63, 247, etc.

Give the cube of 13, 51, 563.

Find the fifth power of 3, 7, and 11.

These exercises are given first because they are easier, and at the same time lead up to the converse sort. Next lead the children up to the rules for testing divisibility. It is not advisable to insist on a rigid mathematical proof in each case. The rule should be deduced at first empirically by taking a large number of cases. The teacher must exercise his judgment as to whether the class can grasp the general proof at this stage. If they can, it should be given; if not, they should be told that the examination of a few cases does not prove that the rule holds good always, but that a better proof will be given later on. The following shows the steps by which the test of divisibility by 2 may be taught.

(*a*) Multiply several numbers by 2—for example, 7×2, 8×2.

(*b*) Let the children examine the products and find out whether they are odd or even. Let them examine the digits separately. They will find that, although the other digits may be odd or even, the unit's digit is always even—that is, always divisible by 2. Hence we assume, as far as our examples show, that any composite number of which 2 is a factor must have a unit's digit divisible by 2.

(*c*) Try by division whether (1) any numbers taken at random of which the unit's digit is divisible by 2 are divisible by 2; and (2) whether it is possible to write any digits in front of 1, 3, 5, 7, or 9 (which are the digits not divisible by 2), so as to form a number divisible by 2.

(*d*) Show that if the unit's digit be taken from a number—for example, 52, 37, 46, 425—the remainder is a number of tens—50, 30, 40, 420; and since one ten is divisible by 2, any number of tens must be divisible by 2. Hence it is the unit's digit that determines whether there is a remainder or not.

There are few classes so dull that they cannot grasp this, and benefit by learning it, if it is properly taught; and if this rule has been made clear, the rules for divisibility by 5, 4, and 25, and by 8, are easily mastered, as they run on similar lines. The analysis of numbers to prove the rule for divisibility by 3, 9, and 11 is a little too advanced for beginners, but the application of the rule is easy enough.

In teaching these rules the tendency is to work only for positive results. Thus the teacher illustrates the rule for divisibility by 9 by taking such numbers only as have a multiple of 9 for the sum of their digits, and showing that these are divisible by 9. He should also take numbers the sum of whose digits will not make a multiple of 9, and show that such numbers are not divisible by 9.

Abundant exercises should be given on resolution of numbers into prime factors, and it should be shown that the only possible divisors of a number are the prime factors taken either singly or in groups.

As an application of this, give exercises on finding all the possible divisors of a number by resolving it into prime factors, and taking these factors one, two, three, etc., at a time. $72 = 2 \times 2 \times 2 \times 3 \times 3$. The divisors got by taking the factors

(*a*) One at a time are 2, 3.

(*b*) Two at a time are 2×2, 2×3, 3×3.

(*c*) Three at a time are $2 \times 2 \times 2$, $2 \times 2 \times 3$, $2 \times 3 \times 3$.

(*d*) Four at a time are $2 \times 2 \times 2 \times 3$, $2 \times 2 \times 3 \times 3$.

(*e*) Five at a time are $2 \times 2 \times 2 \times 3 \times 3$.

The list is completed by taking 1 which does not include any of the factors. Thus the divisors of 72 are 1, 2, 3, 4, 6, 9, 8, 12, 18, 24, 36, and 72. The teacher who has studied permutations and combinations will have no difficulty in seeing that the total number of divisors can be found by increasing by one the number of times each factor occurs, and multiplying the results. Here, for instance, there are three twos and two threes: $(3 + 1) \times (2 + 1) = 12$, which is the number of divisors.

As we seldom want to find how many divisors a given number has, a few of these exercises will be sufficient to lead up to the next step, which consists of finding all the common divisors of two numbers.

Take two such numbers as 70 and 84, and resolve them into their prime factors $2 \times 5 \times 7$ and $2 \times 2 \times 3 \times 7$. Without troubling to make a complete list of all the divisors of *each*, we point out that 2 and 7 are found in each, and consequently among the divisors of each must be found 2, 7, and 2×7. Moreover, these are the only divisors of *both*, because the other divisors of 70 contain 5, and cannot therefore divide 84, which does not contain that factor; and similarly the other divisors of 84 contain a second 2 or a 3, and therefore cannot divide 70.

The crowning point consists in showing that the greatest common divisor of two numbers consists of the product of all common prime factors. The greatest common divisor is also called the greatest or highest common factor (G.C.F. or H.C.F.) and the greatest common measure (G.C.M.).

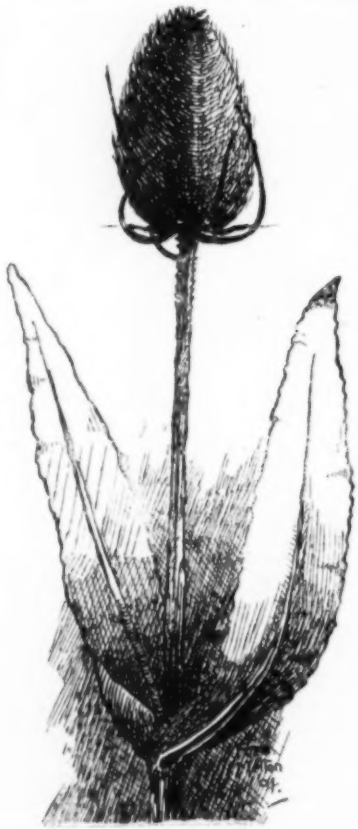
In our next number we shall deal with a method of finding the H.C.F. of numbers which are not easily factorised. But too much attention cannot be paid to the composition of the H.C.F. and its relation to the prime factors of which the numbers are composed. Few questions appear in Scholarship papers more frequently than the one which calls upon the student to resolve some given numbers into their prime factors, and thence deduce their H.C.F. (or G.C.M.).

NOTES OF LESSONS ON "HOW PLANTS DEFEND THEMSELVES."

Class.—These lessons are intended for Standards IV. and V., but the subject is so fascinating and interesting that, if the lessons are given in simple language, even Standard I. could follow them with pleasure and profit.

Time.—The matter could be dealt with in two or three set lessons of from thirty to forty minutes each, or, as there is no systematic classification involved, it could be dealt with in those few minutes that every good teacher devotes each day to an informal chat with the children on some point of interest.

Step I. Preparation.—In those schools in which nature study is systematically taken, this would form

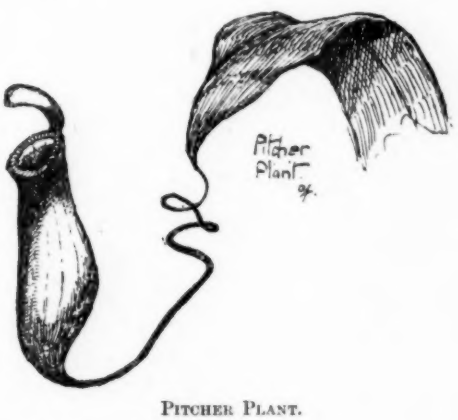


TEASEL.

one of the points of observation in an outdoor excursion. For example, in passing through a field in which sheep or cattle have been grazing, the children would notice that the grass had been cropped quite short by the animals, but occasionally a thistle would rear its prickly head, or tufts of coarse grass had been left untouched, and as far as possible the animals had avoided the golden yellow buttercups. This affords scope for intelligent observation on the part of the children, who should be set to ascertain, if possible, why these plants had been avoided by the animals. Where excursions into the field are not convenient, typical specimens should be obtained, and these should be supplemented by pictures and diagrams.

Step II. Presentation.	Step III. Association.
1. *The enemies of plants.* The enemies against which the plants have to defend themselves are twofold. First, there are those animals which live upon the plants themselves, such as sheep, cows, etc., which browse on the green herbage, or rabbits, which nibble the tender shoot, or the field-mice and voles, which destroy the roots. Then those insects have to be kept off which would rob the flowers of their honey without making any return for it by assisting in fertilisation.	The children should be reminded of what they learned concerning fertilisation in the lesson on catkins. The bees and other flying insects are friends of the plant, because they carry the pollen to the stigma; but ants and other crawling insects are merely robbers, for they consume the honey without benefiting the flower at all, as any pollen that might adhere to their bodies is brushed off and lost as they crawl from one flower to another.
2. *How plants keep off large animals.* The first method that naturally occurs to every one is by means of thorns and spines, as the hawthorn. The sheep will browse all round a thistle, but it never attempts to eat it. The donkey is about the only animal that will attack the thistle, and then only when very hungry.	The children will naturally associate this in their minds with a soldier armed with a spear; or we can compare it to an example from the animal kingdom, such as the hedgehog.
Other plants are endowed with an unpleasant taste or smell, which causes the animals to avoid them. For example, the buttercup and the anemone are very bitter, the wood-sorrel is sharp and acid, while the speedwell acts on the salivary glands and stops the flow of saliva.	Here, again, comparison can be made between the animal and vegetable kingdoms. Many animals, such as the pole-cat and the skunk, are avoided by other animals on account of their disagreeable smell. In olden times also "stink-pots" were employed in warfare, but their use is now discontinued among civilised nations.
A large class of plants, too, have poisonous berries, and these are instinctively avoided by animals.	
In the nettle the poison glands are in the leaves, thus giving rise to the well-known sting.	The serpent, the bee, and the wasp again provide us with objects for comparison and association.
3. *How plants protect themselves from crawling insects.* As it is only from crawling insects, which would lose the precious pollen they carried away, that the plant has to defend itself, we shall naturally look for the means of defence between the flower and the ground.	
Let the children examine the stem of a campion or of a London pride under a magnifying glass, and they will find that it is covered with a number of fine hairs, and near the flower these hairs are tipped with a sticky substance. These hairs prove a far more serious obstacle to the insect than a sharp point would be, as it would crawl round the latter.	History lessons will afford examples of military leaders adopting the same plan, and defending their forces from the attack of superior numbers by means of stockades, etc.

Step II. Presentation.	Step III. Association.
Should any bold insect succeed in getting near the flower, it will only find itself in worse difficulties, as it will be held fast by the sticky hairs, and probably perish.	Here, again, man has adopted nature's methods, and tigers are captured in India by smearing birdlime on leaves. These stick to the animal, who exhausts himself in his efforts to rid himself of them, and so falls an easy victim.
Poison is also employed by the plants as a protection against insects. The leaves and stems of dandelions, poppies, etc., have a thick milky juice, which exudes from the fine punctures made by the insects as they crawl up the stem. This juice, if not actually poisonous to the insect, is at least very disagreeable to it, and thus the plant is protected.	Man again takes a lesson from nature, and protects himself from the troublesome house-fly by means of poisonous fly-papers.
The teasel is well protected from insects. The leaves grow opposite each other on the stem, thus forming a deep cup, in which the dew collects. This proves a fatal obstacle to any insect in its progress up the stem.	This cup of water at once suggests the moat that in feudal times surrounded the castle as a protection against an attacking force.
4. *How the plant turns the tables on the insect.*	
If possible, let the class see a growing specimen of the drosera. They will note that the leaves are covered with stiff hairs or tentacles, each having at its tip a drop of sticky liquid, which has given rise to the name of "sundew," by which the drosera is frequently known.	
If a fly or a small piece of meat is placed on the leaf of the sundew, the tentacles bend over the object and imprison it in the sticky liquid. For two or three days the insect is held tightly by the leaf, which proceeds to digest its victim in exactly the same way that an animal digests its food in its stomach. When the soft parts of the fly have been absorbed, the tentacles open and allow the hard parts to fall off.	The extent to which this absorption by the plant is compared with the process of digestion in an animal will depend on the class, and must be left to the discretion of the teacher.
	Pictures should be shown of foreign carnivorous plants, such as the pitcher plant, etc.



Pitcher Plant.

Step IV. Formulation.

1. Plants must defend themselves from animals that devour their leaves or roots, and also from ants and other crawling insects that rob the flowers of honey without assisting in fertilisation.

Dog Rose.

2. Some of the methods by which plants are protected from the larger animals are :—
   (*a*) By thorns and spines.
   (*b*) By disagreeable taste or smell.
   (*c*) By stinging leaves.
3. They are protected from insects :—
   (*a*) By hairs on the stem.
   (*b*) By sticky and poisonous juices.
   (*c*) By water which gathers in the leaves.
4. In some cases the plant not only catches the insect, but also nourishes itself on its dead body.

Step V. Application.—The children should be encouraged to apply what they have learned, and to extend their knowledge of this extremely interesting subject.

THE INSPECTOR'S NOTEBOOK.

BY AN INSPECTOR OF SCHOOLS.

Oral Expression.

AN important feature in connection with teaching is the proper cultivation of oral expression. This should be begun in the infant room, and should there receive systematic daily attention. We must not forget that the teachers in primary schools have little or no assistance from the home surroundings. It is, therefore, all the more necessary to deal thoroughly with this matter of oral expression. Generally, the whole of the school curriculum should be constructed with this end in view. The teacher must do less, and the children more. Regular talking lessons should be arranged for daily in the infant class. If they are rather informal, so much the better, for there is the danger of drilling our children to be avoided. The little ones should be allowed a certain amount of freedom during such lessons, and encouraged to freely ask questions of the teacher. In the lower standards this method should

be expanded. The object lesson and other oral lessons may well be less stereotyped, and become somewhat informal talks between teacher and individual scholars. In the upper standards there is often plenty of catechising done, but the answering is brief. The elder ones should be trained to stand up and make two or three, or even more, consecutive sentences about the subject under treatment. We need not be so very precise about asking definite questions, which too often are very suggestive. We used to be taught to avoid questions admitting of more than one answer.

At the same time we must avoid being too vague, otherwise we may meet with some such results as the following, referred to by Adams in his *Herbartian Psychology* :—

"When did Charles the First die?" "On a raw and frosty morning."—"How did David the Second die?" "Childless."—"Bruce in his old age lived at Roseneath. While living there he may have fished in the river Clyde. Why could he not fish there now?" "Because he's dead."

In training the powers of conversation and speech, you would give a general question which would allow of a lengthy answer.

Hints thereon. In addition to having a set conversation lesson weekly in the upper standards, I should have a short oral lesson daily, of about fifteen minutes' duration. Immediately after recreation is a convenient time. On two mornings take geography, on two take history, and on the fifth take common things. This daily oral work is sure to tell. Your weekly conversation lesson can be taken on Friday afternoon, and you might try any topical subject—for example, the Russo-Japanese War, a general election, gardening, etc.

In many schools the scholars receive too much help in their oral answering. Teachers frequently go to the extent of giving the first syllable of the one word constituting the answer. For example, "Who wrote the *May Queen*? Ten—" The result of all this is that there is a want of originality among the scholars, and they are not self-reliant.

The "Notebook" Query Column.

All communications to be addressed "Inspector," care of Editor, 33 Paternoster Row, E.C. None but very urgent requests will be dealt with by letter. Two stamps for such replies should be enclosed.

Inquirer asks: "Is it part of an assistant teacher's duties to assist the headmaster in taking the pupil teachers out of school hours, without receiving any extra remuneration for the same, and without any such stipulation being made when such teacher was appointed?" *Inquirer* adds that he is the only male certificated assistant.

Answer.—The duties of an assistant master do not include, unless special arrangement has been made by the managers with him, the instruction of pupil teachers. The responsibility for the proper instruction of the pupil teachers rests primarily upon the managers, and secondarily upon the head teacher. There is nothing to prevent the managers from employing a certificated assistant to instruct the pupil teachers (Schedule VI. of the provisional Code, Section 3: "The pupil teacher shall receive throughout the engagement, from a certificated teacher or other qualified teacher approved by the Board, special instruction," etc.). *Inquirer* should have his duties clearly set forth in his written agreement.

X. Y. is a person trying to qualify as an assistant mistress. She writes: "I have been teaching for some months in an elementary school which has recently been visited by H.M.I. From what he says, I fear I shall not be recognised under Art. 68. If I passed the Cambridge Senior Local in December, would my failure under Art. 68 prevent my recognition under Art. 51?"

Answer.—*X. Y.* would have to take English, and pass in it and the other groups at the Cambridge Senior. She would then be recognised under Art. 51, in spite of failure under Art. 68.

R. F. writes: "I began teaching in August 1902, after passing the Certificate Examination. Will you kindly tell me when I shall have earned my parchment, and if I may leave my present school before actually receiving it? I should like to have charge of a small country school. Should I have a fair chance of obtaining such a post?"

Answer.—Not later than the 1st of March 1904, provided you have been in "recorded service as defined by the Elementary School Teachers' Superannuation Act, 1898, and have obtained a favourable report from an Inspector." You may certainly leave before actually receiving it. I should say you would have a very good chance, unless you are a weak teacher.

M. E. C. requires information respecting the L.L.A. Examination, and the name of a correspondence class which prepares students for this diploma.

Answer.—See answers to *S. H.*, p. 454, and to *Reada*, p. 506. Both Mr. H. J. Smith, 8 Bream's Buildings, Chancery Lane, E.C., and Mr. J. Charleston, 8 Crescent Grove, Clapham Common, S.W., prepare for L.L.A.

H. A. H. writes: "I passed King's Scholarship 1902, 2nd Class. If successful at the January Matriculation Examination, shall I be eligible for admission into a Training College in the following September for a second year's course only?"

Answer.—Are you referring to Art. 115 (*c*) of the Provisional Code? That refers to graduates. No.

I. O. has been studying French, and desires to be examined in that subject. He asks for the names of any examinations open to him.

Answer.—The Society of Arts Examination is the only one I know of. Write to the secretary, John Street, Adelphi, London, W.C. If any reader knows of others, I should feel greatly favoured to receive particulars thereof.

E. W. writes: "I am very grateful to you for the information you sent me some time ago relative to Needlework Examinations."

There are, it seems, at least two bodies which grant certificates—namely, the London Institute for the advancement of plain needlework; the City and Guilds, London. I give a few particulars respecting the former—office, 16 Stafford Street, Marylebone Road, N.W. The object is more especially to provide teachers duly qualified to teach others how to adapt the principles of simultaneous and demonstrative teaching to the subject of needlework. Examinations held in March, June, October. There are four courses—(1) Plain Needlework; (2) Darning and Patching; (3) Knitting; (4) Cutting out. The examination in each course is threefold in character—(1) the Practical; (2) the Written (three questions to be answered on paper on the examination day); (3) the Demonstrative,

which takes place in the presence of the examiners. For each successful examination a certificate is given. When the four certificates are gained, a diploma is bestowed. These diplomas are of four grades—fourth, with a black seal; third, with a red seal; second, with a blue seal; first, with a gold seal.

A COMPLETE SCHOOL COURSE OF ELEMENTARY GEOMETRY.

Section I. C.—Inequalities.

Theorem 16. If two sides of a triangle are unequal, the angles opposite to them are unequal, the greater side having the greater angle opposite to it.

Theorem 17. If two angles of a triangle are unequal, the sides opposite to them are unequal, the greater angle having the greater side opposite to it.

Theorem 18. Any two sides of a triangle are together greater than the third.

Theorem 19. If two triangles have two sides of the one equal to two sides of the other, and the included angles unequal, then the base of the triangle with the greater angle is greater than the base of the other.

Theorem 20. If two triangles have two sides of the one equal to two sides of the other, and the base of one greater than the base of the other, then the angle included by the two sides of the triangle with the greater base is greater than the corresponding angle in the other.

Note.—The proofs of the above may be taken as in Euclid 18, 19, 20, 24, 25, care being taken to give references to the theorems as numbered in this course.

The method of proof (indirect; proof by exhaustion) in theorems 18 and 20 should be noted and explained.

Theorem 19 is most satisfactorily proved as follows:—

Given two △s ABC, DEF, with AB = DE, AC = DF, and ∠BAC > ∠EDF (Fig. 9).

To prove BC > EF.

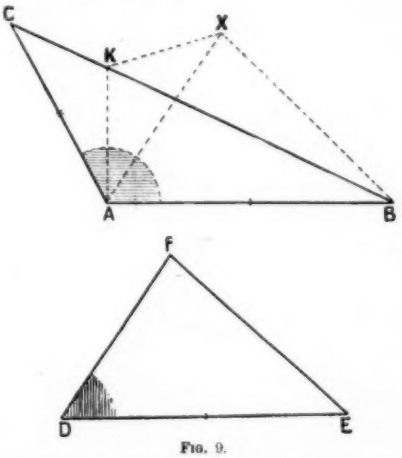


Fig. 9.

Construction: Apply the △ DEF to the △ ABC, so that DE may coincide with AB and F and C may be on the same side of AB. Let ABX represent the position of DEF.

Then, ∵ ∠BAC > ∠EDF,

∴ AX falls within the ∠BAC.

Let AK, the bisector of ∠XAC, be drawn, meeting BC in K. Join KX.

Proof: △s CAK, XAK are congruent (Theor. 10).

∴ KX = KC, and BK + KX = BC.

In △ BKX, BK + KX > BX (Theor. 18).

∴ BC > BX—that is, BC > EF. *Q.E.D.*

Theorem 21. Of all straight lines that can be drawn to a given straight line from a given external point,

(i.) The perpendicular is least;

(ii.) Straight lines which make equal angles with the perpendicular are equal.

Given AB any straight line, C an external point, CO the perpendicular on AB, and CP any other line from C to AB (Fig. 10).

To prove CO < CP.

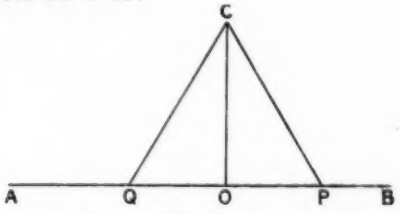


Fig. 10.

Proof: (i.) In △ COP ∠COP is a right ∠.

∴ ∠CPO < a right ∠ (Theor. 7, Cor. 3).

And CO < CP (Theor. 17). *Q.E.D.*

(ii.) Let ∠OCQ = ∠OCP.

Then △s OCQ . OCP are congruent (Theor. 11).

And CQ = CP. *Q.E.D.*

Constructions.

The following constructions require a straightedge, unmarked, for the purpose of joining any two points, or for producing any straight line, and a compass for describing circles with any centre and radius, and for transferring distances.

By means of the theorems already proved we shall (where necessary) demonstrate the correctness of the constructions.

Problem 1. To bisect a given angle. Given the ∠BAC (Fig. 11). Required to bisect it.

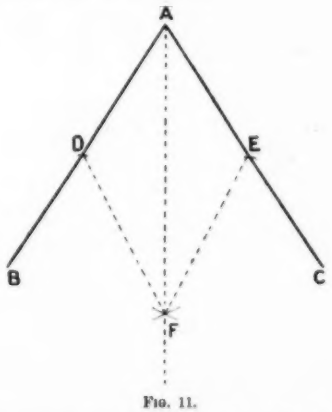


Fig. 11.

Construction: From AB and AC cut off AD = AE. With D and E as centres, and radius greater than half DE, describe two equal circles intersecting in F.

Join AF. Then AF bisects ∠BAC.

Proof: Join DF, EF.

In △s ADF, AEF

AD = AE (Constr.),

DF = EF (Constr.),

AF is common.
∴ △s are congruent, and
∠BAF = ∠CAF. *Q.E.F.*

Problem 2. To bisect a given straight line.
Let AB be the given straight line (Fig. 12).

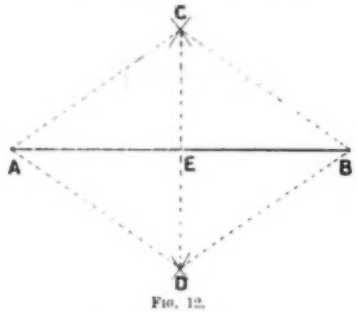


Fig. 12.

Construction : With A and B as centres, and any radius greater than half AB, describe two equal circles intersecting at C and D.
Join CD, cutting AB in E.
Then E is the middle point of AB.
Proof : Join AC, BC, AD, BD.
△s ACD and BCD are congruent (Theor. 14).
∴ ∠ACE = ∠BCE.
△s ACE and BCE are congruent (Theor. 10).
∴ AE = EB. *Q.E.F.*

Problem 3. At any point in a straight line to make an angle equal to a given angle.
Given point A in straight line BC, and given ∠DEF (Fig. 13). Required to construct angle at A = ∠DEF.

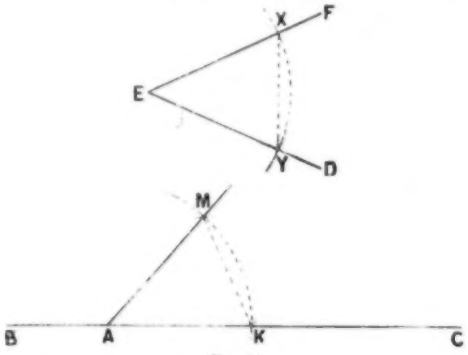


Fig. 13.

Construction : With centre E and any radius, describe a circle cutting ED, EF in X and Y.
With centre A and same radius describe circle cutting BC in K.
With centre K and radius equal to XY, describe a circle cutting KM in M. Join AM.
Then ∠KAM = ∠DEF.
Proof : △s XEY, MAK are congruent (Theor. 14).
∴ ∠KAM = ∠DEF. *Q.E.F.*

Problem 4. To draw a straight line perpendicular to a given straight line from a given point in the line.
Given AB a straight line and P a point in it (Fig. 14).
Construction : From PA, PB cut off equal lengths PK, PM.
With K and M as centres, and any radius greater than half KM, describe two equal circles intersecting in O.
Join PO. Then PO is perpendicular to AB.
Proof : Join KO, MO.

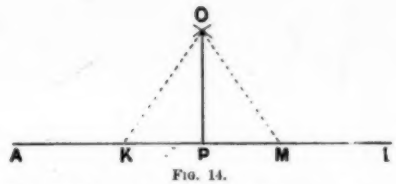


Fig. 14.

△s KPO, MPO are congruent (Theor. 14).
∴ ∠KPO = ∠MPO.
And PO is perpendicular to AB. *Q.E.F.*

Problem 5. To draw a straight line perpendicular to a given straight line from a given point outside the line.
Given a straight line AB, and P an external point (Fig. 15).

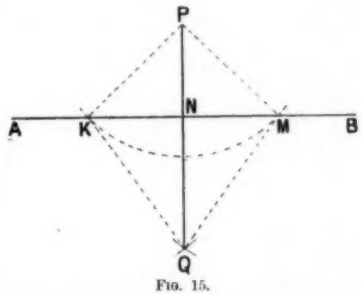


Fig. 15.

Construction : With P as centre, and any convenient radius, describe a circle cutting AB in K and M.
With K and M as centres, and any convenient radius, describe two equal circles intersecting in Q.
Join PQ, cutting AB in N.
Then PN is perpendicular to AB.
Proof : (Two steps).
1st. △s KPQ and MPQ are congruent (Theor. 14).
Hence ∠KPQ = ∠MPQ.
2nd. △s KPN and MPN are congruent (Theor. 10).
∴ ∠PNK = ∠PNM.
And PN is perpendicular to AB. *Q.E.F.*

Problem 6. To construct a triangle having its sides equal to three given straight lines.
Given A, B, C, the three straight lines

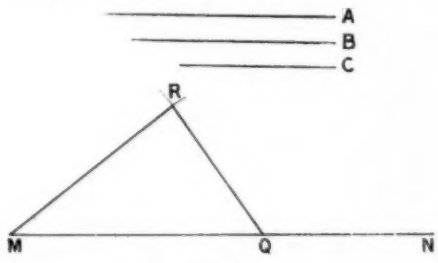


Fig. 16.

Construction : Take any line MN (Fig. 16).
Cut off MQ = longest side A.
With M as centre, and radius equal to B, describe a circle.
With Q as centre, and radius equal to C, describe a circle cutting first circle at R.
Join MR . QR. Then MRQ is the △ required.
Note.—It is most convenient to draw the longest side first. Also the straight lines given must fulfil the condition of Theorem 18. Whichever side be taken as base, it is easy to show that the △s obtainable are identical by superposition.

The Practical
Infant-School Teacher.

ADMISSION EXAMINATION FOR PUPIL TEACHERS, 1904.

BOARD OF EDUCATION, WHITEHALL, LONDON, S.W.,
5th February 1904.

SIR,—1. The Collective Examination held by the Board of Education for enabling Candidates to qualify for engagement as Pupil Teachers, in accordance with Article 35 of the Provisional Code for 1903, and Article 9 (*b*) of the Regulations for the Instruction and Training of Pupil Teachers, will take place on Saturday, May 14, 1904. A Supplementary Examination for the benefit of those Candidates who, owing to illness or some other sufficient reason, are not able to attend on the earlier date, will take place, if required, on **Friday, May 27th.**

2. It appears to the Board that the names of those boys and girls who desire to offer themselves for examination may best be collected by the Local Education Authorities for Elementary Education. H.M. Inspectors have therefore instructions to arrange with these Authorities for Centres at which the examination can most conveniently be held. Suitable schedules for the names of Candidates will be issued by the Board. The names should be entered on these by the Authority in triplicate, and in strict alphabetical order. The Inspectors will subsequently record upon them the success or failure of each Candidate, and will forward one copy of each schedule to the Authority, and another to the Board.

3. The Collective Examination is open to all suitable Candidates without regard to religious belief. It is not necessary for admission to the Examination that a Candidate should have received a nomination to a Pupil Teachership in any particular School.

4. The names of Candidates for the Examination may be received by the Local Education Authority, either by direct application from the Candidate or through the Managers of Schools, whether Elementary or Secondary, within the area. Instructions with regard to the various grades of the Examination and the conditions under which it is held are appended to this Circular.

5. An Authority may properly refuse to accept the name of any Candidate who will not be old enough for engagement as Pupil Teacher within two years of the date of the Examination, or who fails to send in his name by a date to be fixed by the Authority. Candidates who for any other reason are obviously unsuitable may be rejected by the Authority, with the consent of the Inspector.

6. The Local Education Authority should require from the parents or guardians of each Candidate a statement in writing of the desire of the Candidate, if successful in the Examination, to serve as a Pupil Teacher. But it must be understood that the Examination conducted by the Board will be merely a qualifying Examination; success in it does not necessarily confer a right to employment as a Pupil Teacher.

7. It is at any time open to the Local Education Authority or to the Managers of a Pupil-Teacher Centre to submit to the Board of Education a scheme for an Examination of intending Pupil Teachers to be held by themselves in lieu of the Board's Collective Examination, in accordance with Article 9 (*c*) of the Regulations for the Instruction and Training of Pupil Teachers. The Collective Examination for 1905 will be remodelled with a view to making it a general test of proficiency, which can be passed without the necessity of preparing special books or subjects by Candidates who have been instructed in accordance with the ordinary curriculum of a Secondary School or a Preparatory Class.

8. It is desirable at this juncture that every Local Education Authority should consider closely the various problems connected with the supply, not only of Pupil Teachers, but also of Adult Teachers, for the Elementary Schools throughout their area, and that they should then estimate approximately the number of Pupil Teachers that will be required in the area during the year or two years next ensuing after the date of the Examination, in order to provide, in the future, an adequate supply of students qualified to enter the Training Colleges, and subsequently to improve and increase the Teaching Staffs of the Schools.

9. It will be remembered that the Prefatory Memorandum issued by the Board in July last with the Regulations urged the necessity of establishing "in every area some effective means for drawing candidates for the teaching profession from among the most intelligent and capable boys and girls attending the Elementary and Secondary Schools." The steps taken in regard to the approaching Collective Examination for the admission of Pupil Teachers will furnish an opportunity for initiating this much-needed procedure in the areas of the various Local Authorities. Full information as to existing and future vacancies for Pupil Teachers and as to the Collective Examination should be sent by every Local Authority to all Schools, both Secondary and Elementary, from which Pupil Teachers are likely to be drawn; and the Board trust that your Authority will also take every step in their power for bringing home to the parents of school children throughout their area a knowledge of the fact that this door to the teaching profession is now thrown open in a manner and to a degree not hitherto possible.—I have the honour to be, Sir, your obedient servant,

ROBERT L. MORANT.

To the Secretary to the Education Committee.

N.B.—The greatest care should be exercised to ensure that every Candidate is entered upon the proper Schedule and receives the proper papers for the Grade in which it is desired that he should be examined.

INSTRUCTIONS.

A.—The papers set for the 1904 Examination will be of four Grades, and will be distinguished, together with the corresponding Examination Schedules, by numbers and also by colours, as follows:—

Grade I.—Yellow. (Subjects specified for Candidates for a one year's engagement in Schedule V. of the Provisional Code, 1903, and Schedule II. of the Pupil-Teacher Regulations, 1903.)

Grade II.—Green. (Subjects specified for Candidates for a two years' engagement in the Schedules.)

Grade III.—Brown. (Subjects specified for Candidates for a three years' engagement in the Schedules.)

Grade IV.—Pink. (Subjects specified for Candidates for a four years' engagement in Article 39 (*b*) of the Code.)

The Local Education Authority should inform H.M. Inspector, not later than April 9th, exactly how many Candidates will require examination in each of these four Grades. In determining the Grade in which a Candidate is to be examined, the following points should be kept in mind:—

1. Candidates who are old enough for appointment as Pupil Teachers from the 1st of August 1904 should, as a rule, be presented in Grade II.

2. Candidates who are not old enough for appointment from the 1st of August 1904, or who are not prepared for examination in the subjects prescribed for Grade II., **may be examined in Grade III., and**

(*a*) may, if they subsequently receive a year's full-time instruction in a Secondary School or a Preparatory Class, be appointed as from the 1st of August 1905 without further examination; or—

(*b*) may, if they are old enough, and have been actually in-

structed as Pupil Teachers and employed in Public Elementary Schools since the 1st of January 1904, be appointed for a period of three years from that date.

(*N.B.*—The Board do not propose in future to admit any Pupil Teachers who have not passed a qualifying examination previous to the date from which their admission is desired; but in view of the necessarily transitional nature of the arrangements for the current year, they will, for it alone, continue their former practice in this respect.)

(*c*) **Where it is shown to the satisfaction of the Board that it is impossible to provide for the full-time instruction of intending Pupil Teachers between the ages of 15 and 16 by as early a date as the 1st of August 1904, they will be prepared to specially defer the date, from which appointments of Pupil Teachers for three years' engagements will cease to be sanctioned, until the 1st of August 1905.**

3. Candidates for a shortened term of engagement of one year, under Article 8 of the Pupil-Teacher Regulations or Article 40 of the Code, should be examined in Grade I.

4. Candidates, for whose appointment in rural schools for a period of three years the special consent of the Board is to be asked under Article 8 of the Regulations, should be examined in Grade III.

5. Candidates, for whose retrospective engagement in rural schools for a period of four years from the 1st of January 1904 the consent of the Inspector is similarly to be asked under Article 39 (*b*) of the Code, should be examined in Grade IV.

B.—The Examination will begin at an hour to be arranged by the Local Education Authority and H.M. Inspector; and Candidates will be supplied with exercise books and blotting paper. No book or writing from which answers may be copied, and no instrument or material for writing, except pens, ink, pencil, knife, india-rubber, and ruler, may be brought into the Examination Room.

Candidates in Grade IV. are not examined in Needlework. All other girls must provide themselves with the necessary materials and appliances for working the prescribed exercises in that subject.

(See "Needlework" Column, 10 (*b*), in Schedule V. of the Code, 1903, and Schedule II. of the Pupil-Teacher Regulations.)

No Candidate in any Grade will this year be examined in Practical Music.

C.—No Candidates for recognition as Probationers under Article 33 of the Code for 1903 will be examined at the Collective Examination. Such Probationers may, however, be presented to H.M. Inspector at his visit to any Public Elementary School, or at the Centre at which the Collective Examination is held. No such Probationers will be recognised for the first time from the 1st of August 1904, or any later date; but Probationers previously recognised may continue their services until the age of 16.

PUPIL-TEACHER GRANTS AND COLLECTIVE EXAMINATON, 1904.

BOARD OF EDUCATION, WHITEHALL, LONDON, S.W.,
22nd March 1904.

SIR,—I am directed to inform you that the Board of Education find it possible to make a considerable increase in the rates of Grant in respect of Pupil-Teacher Centres and Preparatory Classes fixed by the Regulations for the Instruction and Training of Pupil Teachers issued in July last. The regulations will be revised so as to provide for Grants of £6 instead of £3 under Article 24, and of £4 instead of £2 under Article 25.

It has been represented to the Board that the proposed new Regulation, limiting admission as Pupil Teachers on and after the 1st of August 1904 to candidates over 16 years of age, may create a difficulty in certain localities where it is impossible to provide for the full-time instruction of intending Pupil Teachers between the ages of 15 and 16, by so early a date as the 1st of August next.

Where, therefore, the Board are fully satisfied that this is the case, they will be prepared to suspend the operation of the proposed new Regulation until the 1st of August 1905, and will admit Pupil Teachers between the ages of 15 and 16 for a three years' engagement from the 1st of August 1904, and pay a grant for their instruction during the first year of such engagement under Article 28 of the Regulations. Any Local Education Authority for Elementary Education desiring this special treatment for the whole or any part of their area should make an application to the Board not later than the 1st of June 1904.

The instructions given in Circular 496 with regard to the admission of candidates to the various Grades of the Collective Examination in May next will require a slight modification in view of this concession. I am, therefore, to enclose a revised version of the Circular, and to call your attention to the passages printed in black type. This opportunity has been taken to insert one or two other small corrections and additions in the Circular.—I have the honour to be, Sir, your obedient servant,

ROBERT L. MORANT.

THE GENESIS AND LORE OF THE FAIRY TALE.

BY J. EDWARD PARROTT, M.A., LL.D.

PERHAPS the most striking and encouraging feature of the latter half of the nineteenth century is the efflorescence of a deep interest in things that are young. Especially is this evident in the field of education. Compulsory education is wholly a growth of the last thirty-five years, and the conscious and direct study of the child is even younger. Child study is still in the nebulous stage; it has yet to condense into a formal science. Nevertheless, it has already taught us that there is a child life and a child psychology clearly differentiated from that of the adult, and only to be apprehended by observation and experiment upon the child itself. As for our educational theories, no longer may we spin like the spider—from within; we must derive the substance from the child itself. No longer may we be deductive, but inductive; we must rigidly refrain from generalising a body of educational principles until we have accumulated a mass of data scientifically adequate. We have, however, discovered that childhood is not incipient adulthood, that the child is not father to the man, but that childhood is a series of distinct and periodic phases of existence, each with phenomena all its own.

One of the subsidiary marks of this new interest in things that are young is the revival of the fairy tale. To the early Victorians, with notable exceptions, the fairy tale was *tabu;* to the Gradgrinds who then flourished as the green bay tree it was anathema. To them the fairy tale was woefully at variance with facts, and facts were supposed to exclude every vestige of imagination. "The light that never was on land or sea" was a will-o'-the-wisp that led its credulous followers into the Slough of Despond. Anything not founded on facts was a lie—nothing more nor less—and lies meant damnation.

In obedience to the tenets of a grim theology, the little one was considered an unregenerate child of sin from which it could only be weaned by terrorism and much chastisement. The child literature of the early Victorians was conceived on this principle. The horrible example abounded. The pale and nauseous cast of a strictly and very palpable moral purpose sicklied o'er every story and verse intended for the schoolroom. The average child was by nature depraved. Here and there, to point a moral and adorn a tale, there was a child-angel who invariably died young; the majority, however, lived long, and had a distinctly Satanic predisposition. The real child did not exist at all.

It was early observed that the fairy tale irresistibly attracted and aroused the deep interest of the young child. It was also perceived that the incidents of these tales were sometimes immoral. When Cruickshank tried to illustrate "Puss in Boots," he found it from his point of view quite unfit for the young. Puss, as you will remember, is a shameless and unscrupulous adventurer, a master of fraud, who, by drawing the

longbow and deluding simple rustics, manages to enrich her master, who is *particeps criminis* in the second degree. Cruickshank, with the fear of the schoolroom moralist before his eyes, could not stomach this at all. "When," he says, "I came to look carefully into the story, I felt compelled to rewrite it; for as it stood the tale was a succession of successful falsehoods—a clever lesson in lying—a system of imposture rewarded by the greatest worldly advantages. A useful lesson, truly, to teach children!" This "bowdlerising" of the story was denounced at the time as a "fraud upon the fairies," and "as the intrusion of a whole hog of unwieldy dimensions into the fairy flower-garden." Mr. Ruskin thought those who committed the "folly of purpose" and wilfully perverted the old incidents to teach copy-book headings fit subjects for his ready wrath. Instead of moral habit compelled by righteous authority, such as is everywhere patent in the pitiless morality of the old tales, these literary upholsterers were merely offering the vicarious precept and the second-hand example.

Now though, no doubt, the Master Cat was flagrantly immoral, it is extremely doubtful whether his example ever made any child a rogue. The "penny dreadful" has, perhaps, made criminals, but the fairy tale has not. The fact is that the original and inherent attraction of the fairy tale has ceased when the hero-worship stage sets in. Children outgrow the fairy belief before the period arrives when literary characters become subjects of imitation and emulation. In the commerce of the everyday world children soon learn that the *dramatis personæ* of the fairy tale are figments of the imagination, and nobody ever modelled his conduct upon that of a creature who could not and did not exist. I think, therefore, that we may still tell the ancient fairy and folk tales to our children without any fear of criminal consequences.

While, however, the heroes and heroines of fairy-land may do what appear to us nefarious deeds, and may practise that "slimness" which primitive and even semi-cultured races regard as worthy of admiration, the teaching of the tales, on the whole, is thoroughly wholesome. Charles Dickens observed that "it would be hard to estimate the amount of gentleness and mercy that has made its way amongst us through these slight channels;" while another devoted lover of children, and a muscular moralist to boot, has remarked, "Wherever is love and loyalty, great purpose and lofty soul, though in a hovel or a mine, there is Fairyland."

Most of the old fairy tales as now offered to children teach the ultimate conquest of good over evil, the supreme virtues of self-denial and consideration for others, the beatitude that the poor, the humble, and the oppressed shall receive a great meed if they are only brave, constant, and true. They teach the deception of mere outward appearances, that "kind hearts are more than coronets," that might eventually yields to right, that the meanest creatures are often the most potent instruments of good, and that even the most trifling act may have great and far-reaching results. These lessons—and they are but few out of the many that may be deduced from the fairy tale—seem to me no despicable armour with which the child may be girded for the battle of life.

We may now ask ourselves the question, Why do these ancient fictions appeal so forcibly to the child at a certain stage in its mental development? The results of child study can help us here. According to what is known as the recapitulation theory, the child's mental development runs parallel with that of the race. Every broad evolutionary stage in the mental history of mankind is reproduced serially in the brief years of child life. The child is indeed the heir of the ages; he is their epitome, immensely compressed as to time, but complete on every page. A thousand years of development are but as yesterday; nevertheless the child's watch in the night reproduces faithfully every mental attitude and aptitude of the upward-groping race. The three hours' traffic of the stage frequently comprehends the history of many years. Similarly the cinematograph of the child-mind discloses *in petto* the drama of countless ages.

The answer to our question, then, is clear. At the period when the fairy belief holds sway the child's mind is that of the primitive man who first crystallised in these traditional tales his view of the marvellous and bewildering world about him. At this stage the child and the savage are in mental comradeship. They clasp hands across the ages, and despite the efflux of long centuries, the one instantly recognizes the other as kinsman. If a vibrating tuning-fork be held over the silent piano one string will throb in sympathy and echo its music. So does the fairy tale thrill the child-mind when attuned to it. All the mystery and magic of bygone ages, only to be appreciated in later years by the dim remembrance of an early joy, then stirs an answering chord in the child's bosom.

To some few adults, such as to him who wrote the *Child's Garden of Verse*, is it given to resume the age when the mind is a magnet of marvels, when one perceives no incongruity and is startled at no unreality, when one would be not at all surprised if the birds and beasts were to address us, and a fairy were to appear from behind the nearest rosebush.

The old, old stories, then, are the child's peculiar and particular heritage of the ages; their "young-eyed poesy" is verily "hoar antiquity." They are eternally vitalised because they are the outcome of that imagination that is eternally young. The traditional tales, then, are founded on a rock, and the swirl and eddy of time and fashion cannot drown their inherent appeal.

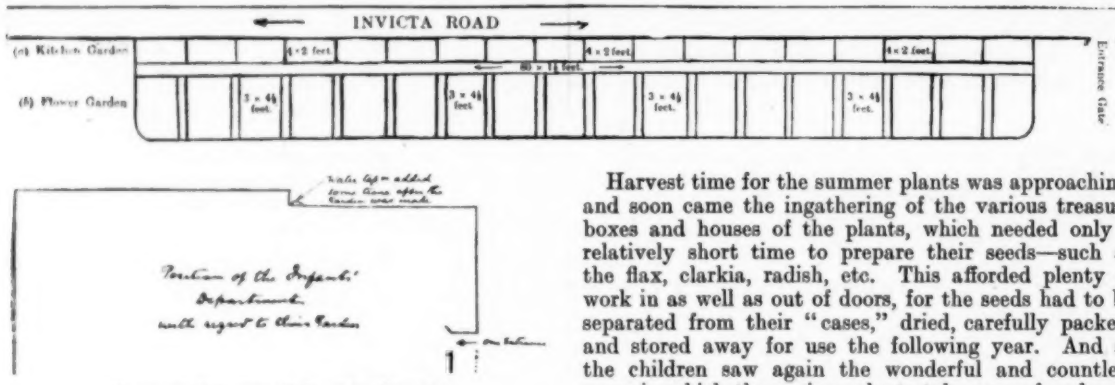
The poet sings sadly of ripening years,—

> "They are gone—beautiful fictions of our fathers,
> Wove in superstition's web when time was young,
> And fondly loved and cherished. They are flown
> Before the wand of science."

What is called the march of civilisation has swept away the old and widespread beliefs in elves, witches, brownies, giants, trolls, changelings, and all the other inhabitants of the mystic land of Once-upon-a-time. Science, the stern iconoclast, shows us the elves as mere lingering memories of neolithic man, and the fairy rings on the sward where the nightly revels were held mere fungi that perversely prefer to grow in a circle. It would not be difficult, however, to discover, even within the bounds of our own islands, in that fast-vanishing Arcadia where the locomotive is unknown and the elementary school is far away, a real though shame-faced belief in fairy power.

Still, science, as is her wont, has made amends. In compensation she has cast her mantle over these old tales, and her votaries scour the wide earth, literally, from China to Peru for legendary lore. The primary object of such collectors has not been altogether æsthetic; the secondary gains, however, have opened up new sources of delight for every child from eight to eighty.

(To be continued.)



PLAN OF "INVICTA" SCHOOL GARDEN.

SCHOOL GARDENING FOR LITTLE CHILDREN.

BY LUCY R. LATTER.

PART II.

"And the spring arose on the garden fair,
Like the spirit of love felt everywhere;
And each flower and herb on earth's dark breast
Rose from the dreams of its wintry rest."

WHILE the spring flowers were gradually making a brave show in the bulb-beds, other things had to be set in the remaining beds of the garden.

Red and blue flax, larkspur, clarkia, eschscholtzia, stocks, sunflowers, and mignonette were among the seeds sown in the flower garden; and radishes, lettuces, onions, carrots, and runner beans in the kitchen garden—with the result that we had a glorious show of sweet and beautiful flowers, and goodly, if but small, crops of vegetables, the ensuing summer (1902).

The bulb-beds had meanwhile to be attended to. As the crocuses, for instance, finished their work above ground, their leaves were plaited and the ends neatly stuck down in the soil. Whilst the crocus-beds were thus being tidied up, the seed or treasure boxes of some of the crocuses were found and taken care of. And so with the other bulbous plants: they in turn received special attention, and every new seed-box was hailed with delight by the children. The seed-box of the iris should be specially looked for by those who have any such plants in their garden—it is so very beautiful. Some hardy annuals taken from over-crowded beds were planted among the bulbs from time to time; in this way the bulb-beds looked tidy and pretty all the summer months. Meanwhile the children had ample opportunity of watching the bee and butterfly visitors to their garden. The earth-worm, too, was a source of great interest: one was found in the little channel it had so carefully made as a means of exit to the upper surface of the earth. The dew on the nasturtium (*tropæolum*) leaves one morning stirred the children's imagination. The perfect little drops glistening on the green shields, held up as if to protect the flower beneath from the sun's rays, suggested the touch of a magic wand. Another day the children noticed that the plants were all bending in one direction. Æolus had passed unseen through the garden, and touched the frail plants with his breath "in greeting wild."

Harvest time for the summer plants was approaching, and soon came the ingathering of the various treasure boxes and houses of the plants, which needed only a relatively short time to prepare their seeds—such as the flax, clarkia, radish, etc. This afforded plenty of work in as well as out of doors, for the seeds had to be separated from their "cases," dried, carefully packed, and stored away for use the following year. And so the children saw again the wonderful and countless ways in which the various plants take care of and provide for their little seeds, and glimmerings of their own parents' care for them were thereby awakened in them.

As to the destiny of the produce of our garden, one of our greatest objects is to help the children to experience the joy of real giving, the high privilege of true work, and the means which it affords of giving pleasure to others. When, therefore, the harvest time comes, we like to share the produce of our garden with others—perhaps with some little children who have no garden of their own. Sometimes a comrade is ill, and a few flowers go to cheer him; whilst parents and teachers are not forgotten by the little ones in the distribution of their gifts. On one occasion, during some very cold weather, we were able to invite fourteen of our children, who "happened" to be very poor, to a "feast" of boiled potatoes and butter. The potatoes had been grown in our own garden. All the preparations for the "feast"—the washing and boiling of the potatoes, the setting of the tables, etc.—were made by small groups of children, who also saw to the clearing and washing up of the plates and spoons, etc.

Each class holds a certain number of beds in the garden each year, according to the size of the class, so that children from every part of the school have a share in the outdoor garden work.

The actual owners of the beds for the time being may invite some of their comrades to help at any busy season—for instance, when the garden has to be cleared of the weeds which have grown apace during a holiday, or when the seeds are ready for ingathering. But whilst direct provision can only be made at present for seventy-two little outdoor gardeners each year, opportunities are provided for indoor gardening in pots and boxes for the children who cannot yet have a bed in the garden from the smallness of its size in proportion to the number of children attending the school; and whenever possible, the same plants are grown in as out of doors.

Here I would like to say that experience amply proves that outdoor gardening with little children should only be taken as group-work—that is to say, with but a small number of children at a time. Except for such work as watering the beds, or removing any stones from the same, when more children may easily be employed, from eight to ten children are about as many as one teacher alone can keep really occupied at a time, for she has to superintend and direct so many different operations the while. One bed may require weeding, another may have to be raked over, whilst in the kitchen garden there may be some runner-beans to string up, or some carrots to thin out, and numberless

other things. This leads to another point—namely, the advisability, particularly under the present conditions of school life, of beginning on a small scale. Whilst it is most desirable to secure as much ground as possible

SPRING-TIME IN OUR GARDEN.
"Crocus and hyacinth with rich inlay broidered the ground."

for gardening purposes, it will be well at first to lay out only a portion of it in little beds for the cultivation of flowers and vegetables, etc., and to sow the remainder with grass seeds. Grass has many wonderful secrets to reveal to the loving heart, the seeing eye, and the listening ear, for there is not

"A blade too mean
To be some happy creature's palace."

As the possibilities for gardening become greater, more ground may be taken in for the garden from the little field of grass. Pending its being required for more special cultivation, a few bulbs may be set in the little field. Bulbous plants always look pretty among grass.

Gardening of any kind means much loving labour and time, but the expenditure of both is more than justified by the value of such work to the children physically, morally, and intellectually. In my school twenty minutes every morning (9.40–10 a.m.) is devoted in every class to the care of natural objects by the children—that is to say, to the setting, tending, and watering of plants in and out of doors, the cleaning of the flower-pots and saucers, the preparing of flower-boxes for the classrooms and hall, the feeding and tending of animal pets, the cleaning of the homes of the same, etc. An additional twenty minutes is allowed on Mondays—at the end of the afternoon session in the case of the three upper classes, and in the morning in the case of the three lower ones, for the special cleaning of the shelves, etc. To gardening in and out of doors with groups of children *at least* forty-five minutes a week are given, according to weather and needs. Twice a week thirty minutes are devoted in the morning to the consideration of special natural objects or phenomena (the object lessons of the Government Code).

Believing it well to let the children pause a little in the midst of the hurry and rush of our modern life, one natural object is selected on which specially to concentrate our thoughts and work for a few weeks. This does not prevent the general observation of the many things which come under our notice, but rather helps to show that "nothing stands alone;" for there -- then time to consider the subject from all sides—that is to say, in its relation to other plants, animals, and natural phenomena, and also as it affects the daily life of the children. It also often happens that we have to return again to a subject. For instance, the radish was under special consideration during the month of June one year, but it was only in the August and September following that the flowering and fruiting of some radish plants could be brought under the notice of the children.

The subjects are fixed upon and studied long before they actually become objects of special attention in the school. For instance, last April the children sowed carrot seeds in some of their vegetable plots. In the autumn the children pulled up and utilised the produce, so far, of some of their seeds. The subject was not specially considered then. Some of the carrots were left in the ground to continue and complete their work (this year). When this has been done, and when carrots in the earlier stage (grown from seeds which will be sown this spring) appear, the carrot will become a subject for special consideration, the children having witnessed and taken part in the whole life-history of the carrot by then. All the while we try to lead our children to realise that every fresh discovery in the realm of Nature is but a step to something *more*.

The subjects for special consideration are chosen from the list of things growing in the garden, but they also include natural phenomena and animal visitors affecting the garden for good or ill: thus the earth-worm, the garden snail, wind, rain, snow, etc., have all received special attention at the right time.

Our school-garden work is supplemented by walks from time to time with our children to Greenwich Park and Blackheath. In this way the children get a more extended glimpse of the realm of Nature.

The things sown or planted in our garden are of the very simplest kind, such as might be found in a working-man's garden; but the choice of even these is limited.

We found when working in our garden that the stones of which we had made the paths were apt to be kicked out of place by the feet of the little workers; so in the autumn of 1902 I asked the Board that a little of the best Croydon gravel might be put down over the paths to bind the loose stones we had placed there

SPRING-TIME IN OUR GARDEN.
"Sun and summer soon shall be."

together. This was done, and at the same time a cartload of stable manure was brought and put down on the beds.

(To be continued.)

OUR TUTORIAL SECTION

OUR PUPIL TEACHERS' AND SCHOLARSHIP COURSE.

BY ARTHUR T. FLUX,

Late Principal of the Belvedere Pupil Teachers' Centre, First on Scholarship List; Author of "Scholarship School Management," "Building of the British Empire," etc.

SCHOLARSHIP COURSE FOR DECEMBER 1904.
Fifth Month—May.

Work to be Prepared.

1. *Reading and Repetition.*—Regular weekly practice. Oral exercise before a competent critic is very necessary.

2. *Teaching.*—The teaching of spelling. It is impossible for the young teacher to conduct a spelling lesson correctly until he has thoroughly grasped the difficulties that exist in English spelling and the correct scientific methods by which they may be overcome. As we saw in dealing with reading, the alphabet is far from being perfect. In a purely phonetic alphabet each letter should represent one sound and one only, and each sound should be represented always by the same letter. In English this is not so. We have five vowels and fifteen voice sounds. Three of the consonants—*c*, *q*, and *x*—are superfluous; and we have sounds for which we employ two consonants—for example, *th*, *ch*. The vowel *a* has different sounds in *fay, fat, father, fall;* and the sound of *a* (long) may be *a, air, ere, heir, hare,* etc. It is, then, useless to expect little children to find out the spelling from the sound, and special spelling lesson—apart from reading lessons—are essential. Oral spelling by the alphabetic method is also useless. The sound of the word *yacht* does not suggest the individual letters *wy, ay, see, aitch, tea,* and *vice versâ*. Again, spelling is nearly always tested by writing—that is, it is the eye and not the ear which has to be trained. A child may spell a word orally twenty times and then write it incorrectly. This points out the first great rule—Teach by the eye rather than by the ear. Let the class write words on their slates, or copy them from their books, in place of parrot-like oral repetition. The next great point to bear in mind is that the thousands of words which are difficult to spell may be classified upon the basis of some common difficulty. Suppose, for example, the word *know* is spelt wrongly. What is the cause? Surely it is the silent initial *k;* and instead of dealing with the one word, *all* those presenting the same difficulty should be collected on the blackboard, or, better still, on large sheets of paper which can be preserved. If a child makes a mistake in one of them, let him copy out the whole list two or three times. Again, there are many simple rules which may be framed. The *ie* and *ei* difficulty is always present, even among pupil teachers and scholarship students. The rule "E before I after C if the sound rhymes with tea" will solve most of the difficulties.

Of course there are some words which are outside all rules, and these anomalous words should be collected and practised continually. Words sounded alike but spelt differently, and words likely to be confounded, should be brought into juxtaposition, the meaning explained, and the possible mistake pointed out. For example, a week never passes without my having to correct (in a notes of lesson) the spelling of *elicit*. It is very frequently given *illicit*. This mistake would never be made if the two words were put together and the exact meaning of each determined.

Another very valuable method of teaching spelling is by word-building, an exercise of great interest to children if taken properly. Some weeks might profitably be spent with the lower standards in affixing *-ing* to words, and noting when the preliminary consonant is doubled and when not, or when a final *e* is omitted, etc. With the upper standards word-building from roots is a valuable exercise. A whole lesson may be spent on the Latin root *duco, ductum*, I lead. Let the class find out as many words as they can build up from this, and explain the meaning of each—for example, reduce, reducing, reduction, produce, production, product, reproduce, etc. Do not be in a hurry to supply the words. The more children find out for themselves the better pleased they are. Taught properly, spelling is an interesting subject.

3. *Drawing.*—One or two copies each week from photos of casts, and practice from natural objects. The copy must fairly fill a half imperial sheet of paper. I receive many complaints from students that they cannot make much progress with brush and sepia. This is somewhat strange, as brushwork is much easier than pen or pencil work. The difficulty probably is (judging by specimens submitted to me) that the student thinks it essential to obtain fine, hair-like lines, and finds this impossible. Freehand, as the name implies, is drawing freely, and a curve put in rapidly and smoothly, even if somewhat thick, is much better than a hard, fine line done gradually and laboriously. Some students seem afraid to let their hand move freely at all.

4. *Music.*—Students should now be fairly proficient in transposing from one notation to another, and from one scale to another, in staff notation. For this month practise transposition from one scale to another in the Tonic Sol-fa Notation. The questions are usually limited to changes to or from the first flat or sharp key on any scale. Each student must be able to construct a modulator; if this can be done, there is no difficulty at all. Work the following exercise:—

Write the following on the *perfect* method—that is, showing the change of key by means of bridge notes:—

(1.) **d s m r fe s l s d' s fe l s t d'.**
(2.) **m s d m l fe s m d' m fe l s t, d.**
(3.) **s m d d' fe s l s fe l s f r d.**
(4.) **d m s f l ta s ta d' l f m d.**
(5.) **s m f m f l ta d ta l f s m d.**

(The presence of **fe** indicates the first sharp key, **ta** the first flat key.)

Write the following on the *imperfect* method—that is, without change of key:—

(1.) **d r m s ˢd t, d r m r d ᵈs f m r d.**
(2.) **m s d r m ᵐl, t, d r d t, d ᵈs f m r d.**
(3.) **m r d m rˢ, t, l, d t, ᵈs f r m.**
(4.) **d t, d m s d' ᵈ's f m f m r l s d ᵐl t d'.**
(5.) **m s d d' s m f ʳd m s f m r ʳs l t d.**

Regular practice must also be taken in the practical music. *Practical Music for Pupil Teachers* (Curwen and Co. Price 6d.) will afford all the exercises necessary.

5. *Penmanship.*—Ten minutes' daily practice, and care at all times. This subject is lamentably weak. Not one student in twenty can set a really good copy, generally because he has no definite rule to go upon as to size, slope, distance, etc.

6. *Composition.*—Write one or two essays each week on such subjects as:—

(1.) Gardens and their uses.
(2.) Why is Shakespeare considered a great dramatist?
(3.) The duty of a teacher toward the child.
(4.) The study of languages.
(5.) Description of some scene or building.
(6.) Does civilisation produce increased happiness?
(7.) The Reformation.
(8.) Insects and their services to man.

The following notes may be of use in dealing with the subjects.

(1.) Gardens. What they are; the various kinds; gardening as a recreation; the education in gardening—a closer study of nature, a more intimate knowledge of plants and insects, etc.

(2.) Shakespeare as a dramatist. A drama is a representation of life, and the greatest dramatist is he who is truest to life. Shakespeare's characters are alive; we feel we should recognise them if we met them; they are real men and women, not merely puppets. Each character is totally distinct from others. Beatrice is not Rosalind, Hero is not Celia, Cassius and Brutus are distinct, and so on. Shakespeare shows a keener insight into human nature than any other dramatist. He is everything to every man. The lawyer recognises his knowledge of law, the

doctor his knowledge of medicine, the historian his knowledge of history, the philosopher his knowledge of man. His vocabulary is greater than that of any other writer, etc.

(3.) This should be fairly obvious. The imparting of knowledge is a comparatively small part of the duty. The training of all the mental and moral faculties to their fullest extent should be the aim, and not preparation for examinations. To turn out a self-reliant, thoughtful, studious, honest, truthful, punctual, temperate, persevering boy or girl is a noble work.

(4.) A much-discussed subject. Some hold that the study of dead languages is a waste of time, since very few ever attain such proficiency as to read with enjoyment. But it may be fairly opposed that no one has a mastery of English who does not also know something of Latin and Greek. Modern languages are useful from a practical point of view. English people do not readily learn a foreign tongue; they prefer to make others learn English.

(5.) This is an exercise in word-painting. Take an actual view, and endeavour to describe it in words. If you select a building, you should not give the date of erection, who built it, etc., but simply describe what you see.

(6.) Happiness is purely a relative term. A labourer's child making mud-pies by the wayside is as happy as a millionaire's son surrounded with the most costly toys. A poor man gets more happiness often than a rich man, and a negro under his palm tree may be a happier man than a magnate of Park Lane. Civilisation has been described as the education of people to want something which previously they did not want.

(7.) This is a wide subject, and may be treated in many different ways—historically, politically, socially, etc.

(8.) Make sure what an insect is. The uses to man are enormous. As scavengers, they clear away decaying animal and vegetable matter; they fructify flowers; they prevent disease (and spread it); they produce (some of them) useful articles, etc.

I shall be pleased to give a volume of Scott for the best essay sent in this month.

7. *English.*—(*a*) Twenty-five roots and meanings each week.
(*b*) *Much ado about Nothing*, Act III., Scenes i. and ii.
(*c*) The essay on "Travaile."
(*d*) The revival of learning.
(*e*) The grammar and syntax of the pronoun.

Notes.—Students are invited to send up any difficulties in the play. It is impossible to annotate and explain without to a large extent going over the same ground as the text-book and occupying far too much space.

The Revival of Learning, or Renaissance, is a term applied to the great increase in education and art during the fifteenth and sixteenth centuries. The reasons why this should have occurred when it did are obvious to the student of European history. The preceding four or five centuries have been aptly called the Dark Ages—"dark" because it was an age of ignorance, as evidenced by the small number of books which appeared; "dark" because it was a period of continual unrest and warfare. The causes which appear from English history obtain more or less generally on the Continent. In England, from the time of the Conquest till the practical extinction of the feudal system by the Wars of the Roses, the whole period was one of wars and alarms of wars. Learning was despised as fit only for clerics; fighting was the first consideration of the noble, and might was right. Now, in England, and more or less in the whole of Western Europe, the various states and parties had shaken down into peace, the rigid lines of society, as marked by the feudal system, were being erased, and there were (1) leisure to study, (2) material to study, (3) opportunity for study, and (4) inducement to study. The leisure we have explained; the material came from the newly-invented printing-presses, which could turn out books and pamphlets infinitely cheaper than the monk toiling in the scriptorium. The Eastern Empire, with Constantinople as its capital, had been less disturbed than the west of Europe, and it was there that literati collected. The conquest of Constantinople by the Turks in 1453 scattered these scholars all over Europe, carrying with them their manuscript copies of the Greek and Latin writers. Forced to find a living from their knowledge, they commenced teaching in the various large towns, and soon schools and colleges were founded to further their efforts—hence the opportunity of study. The men of the *new learning* also had a stronger inducement than mere curiosity. The religious dispute which arose compelled them, if they wished to take an intelligent part in the conflict, to study the Bible, and also the writings of the Christian fathers. The growing prosperity of England and the more settled state of the Continent permitted the young nobleman to travel and study abroad; and if his mind did not run on the voluminous writings of the schoolmen, he was undoubtedly interested in the Italian drama. The mental outlook widened rapidly in all directions. Not only were there increased facilities for study, but mariners rolled back the mists of darkness which had hung over half the world. Columbus discovered America, De Gama doubled the Cape and reached India, Drake circumnavigated the world, Hawkins started the slave trade with the Spanish colonies, Cabot delineated the coast of America, Willoughby and Chancellor reached Muscovy, Frobisher and Davis braved the rigour of Arctic seas. Trade and commerce followed these mariners, and new ideas and objects were continually appearing. In place of the dozen or so poems of the Dark Ages, the "spacious times of Great Elizabeth" produced a veritable "nest of singing birds." The influence of the Renaissance on the language was great. The study of Latin and Greek introduced many classical words direct from the original, with little or no change in form. Sometimes the same word was already in the language, but so altered by its passage that it was unrecognisable. *Alms* and *eleemosynary* both come from the Greek *eleēmosunē*; *bishop* and *episcopal* both come from *episcopus*—the latter in each direct, the former through Norman, French, or Anglo-Saxon. Study this movement very carefully.

The Pronoun.—Learn a good classification. Be careful to distinguish between *emphatic* and *reflexive* pronouns—for example, I *myself* saw it, I hurt *myself*. The former is emphatic, the latter reflexive. Notice the peculiarities of *but* and *as*. *But* is equivalent to *who* + the negative *not*. There is no man *but* honours you = There is no man *who* does *not* honour you. *As* is used as a relative pronoun after some demonstrative word, as *same*, *such*. *Either* and *neither* refer to two things only. To say "either of the three" is incorrect.

Distinguish also the personal pronoun in the possessive case, and the possessive pronoun in the nominative or objective case.

My, thy, our, your, her, their, are personal pronouns, possessive case. Mine, thine, ours, yours, hers, theirs, are possessive pronouns, *not* (as a rule) possessive case.

8. *Geography.*—(1.) Revise China, Japan, and Asiatic Russia.
(2.) The physical features of British North America.

North-Eastern Asia will, of course, receive particular attention at the present time. The political causes leading to the present war must be understood. Russia, although the second largest empire of the world, is so situated as to be destitute of any open port. The shores of the Arctic Ocean are icebound, the ports on the Baltic could be closed by Denmark, the Black Sea is commanded by Constantinople, and Vladivostock, the most southerly of the Pacific ports, is icebound during the winter. The Russian policy of expansion and annexation has been very largely influenced by this quest of an open port. The occupation of Manchuria was at first to be only temporary, but Russia evidently has intended all along to stay; and it is this violation of agreements which has brought about the outbreak of hostilities. With Port Arthur as the terminus of the Trans-Siberian Railway, the power of Russia would be very seriously increased. The trans-continental line must be noticed. It is in many parts a very primitive railway, consisting of a single line laid on sleepers resting on the ground, and is at present quite unequal to any severe demand for rapid and safe transit.

The development of Japan during the last thirty years must also be studied. The Chinese, with an intense national conservatism, have hitherto successfully resisted the advances of Western civilisation; but the Japs have adopted and assimilitated it so rapidly that in many points they are in advance of the nations of Western Europe.

In dealing with British North America maps must be freely used. The following questions have been asked:—

(1.) Describe the river basin of the St. Lawrence.
(2.) What effects have the mountain ranges of Canada upon the climate?
(3.) Say what you can of the lake system of British North America.
(4.) Compare the climate of the east and west coasts of British North America, and account for the differences.
(5.) Describe the chief physical features of the Dominion of Canada.
(6.) In the opening up of North America its physical geography has been a great help—how?
(7.) What is meant by the Height of Land, The Great Divide, The Great Lone Land, Pine Barrens, The Banks?

9. *History.*—Henry the Fourth to Richard the Third.

The revolution of 1399 was an experiment—an attempt to set up a constitutional monarchy, in which Parliament, the nobility, and the Church concurred. As a reward for support Parliament secured greater powers, the nobility revolted on four occasions, and the Church insisted on the *De Heretico Comburendo* and wholesale persecution of the Lollards. It is not to be wondered at that Henry the Fourth found that wearing a crown was no easy task.

It is important to note how the power of the Commons had

gradually increased. In 1322 they obtained the right to take part in all legislation; in 1340 they fixed responsibility on ministers; in 1362 they introduced the principle that their consent was necessary for taxation; in 1376—and again in 1388—they impeached ministers; in 1407 they claimed and obtained the right to originate all money grants; in 1413 they claimed the privilege of freedom from arrest. But this growth was suddenly stopped in 1430, when, by a disfranchising Act, the right to vote was narrowed so ruthlessly as to leave all power in the hands of a few. And so it remained practically till the Reform Bill of 1832.

Henry the Fifth's reign was taken up largely with the expedition to France. A map should be drawn and the path of the army traced.

Henry the Sixth.—The loss of the French provinces was brought about by political movements in France. Joan of Arc is usually credited with the whole of the success, but she really played a small part. The chief factor of the English success and ultimate failure was the attitude of the Duke of Burgundy, who ruled over a district nearly as large, and possessed an army nearly as strong, as the French king. When the duke, owing to the assassination of his father, threw in his lot with the English, they were, combined, much too strong for the French. The union was strengthened by the marriage of Bedford with the duke's sister. When the latter died the bond was loosened; when Bedford married a ward of Burgundy without his consent it was broken; and then the duke joined the French king, and they *together* were far too strong for the English.

The Wars of the Roses must be studied carefully. A genealogical table showing the exact relationship of the families must be committed to memory.

The weak rule of Henry the Sixth, the unpopularity of the queen, the ambition of the Duke of York, were the chief causes that brought about hostilities. York obtained the protectorship and the promise of the succession; but when the birth of Prince Edward scattered his hopes, he *then*, and *only* then, claimed a better right to the throne than Henry himself.

Learn the battles, etc. Life of Warwick—the causes of his changing sides. Characters of Edward the Fourth and Richard the Third.

Note that the Wars of the Roses were confined to the nobility and their armed retainers. The rest of England flourished during the time. The contest was carried on with a brutal ferocity which practically destroyed the feudal system.

Note Edward's *benevolences*—a precedent which, later on, led to trouble.

10. *Arithmetic.*—Work 401–500 General Examples, Christian and Collar. Revise averages and percentages, pp. 271–285. It is not necessary to work all the examples, but they should be looked carefully through; and if any difficulty is experienced, it should be sent up for solution.

In percentages bear in mind that per cent. means per 100, and not per 120 or something else.

Solutions asked for:—

(1.) *Three numbers are as* 1 : 2 : 3. *The sum of their cubes* = 4500. *Find them.*

The numbers must be some multiple of the ratio 1 : 2 : 3. Let the multiple be m.

The numbers are $1m$, $2m$, $3m$.

And their cubes are $1m^3$, $8m^3$, $27m^3$—a total of $36m^3$.

Now $36m^3 = 4500$.

$m^3 = 4\frac{5}{9}\frac{0}{0} = 125$.

$m = 5$.

And the numbers are 5, 10, 15. Ans.

(2.) *What numbers of four digits each can have* 119 *for G.C.M. and* 13923 *as L.C.M.?*

$13923 = 119 \times 117$, or $119 \times 3 \times 3 \times 13$.

All the possible numbers with 119 for G.C.M. and 13923 as L.C.M. will be

$119 \times 1 = 119$.
$119 \times 3 = 357$.
$119 \times 3 \times 3 = 1071$.
$113 \times 13 = 1469$.
$113 \times 3 \times 13 = 4407$.
$113 \times 3 \times 3 \times 13 = 13923$.

∴ the number of 4 digits are 1071, 1469, 4407.

(3.) *A casket contains diamonds and pearls. The diamonds are worth as many times the pearls as the pearls are worth the casket. The diamonds are worth* £3,411, 9s. 0d., *the casket* £1, 1s. 0d. *Find the value of the pearls.*

On examining a few examples—for example, 1 : 2 : 4, 1 : 3 : 9, 1 : 5 : 25, etc.—it will be seen that the middle term is in each case the square root of the product of the first and last. The answer will be therefore the square root of the product of £3,411, 9s. 0d. and £1, 1s. 0d.

In shillings = $68229 \times 21 = \sqrt{1432809} = 1197$ = £59, 17s. 0d.

11. *Algebra.*—Harder Factors, chapter xxviii., Hall and Knight.

12. *Euclid.*—Props. 40–48, Book I., with six deductions each week.

13. *Elementary Science.*—Chemistry, mixtures and compounds, water and its properties, elementary properties of oxygen, nitrogen, hydrogen, carbon, iron, and mercury.

In dealing with each element, note and learn:—

(*a*) Atomic weight.
(*b*) Occurrence in nature—free or combined.
(*c*) Method of production, with a sketch of the apparatus used.
(*d*) Experiments to show its properties.

14. *General Information.*—Read up answers to two or three of the papers in one of the books of questions used.

Test Paper in General Information.

Answers will be marked gratis if sent direct to Mr. A. T. Flux, Oakleigh, Belvedere, Kent, with stamped addressed envelope for their return.

1. Describe exactly the principle by which soda water is obtained from an ordinary siphon of soda water.
2. How many members are there in the House of Commons? in the House of Lords? What are the Woolsack, the Speaker, Tellers, Prorogation?
3. Use each of the following words correctly in a sentence:—Indictment, nepotism, atavism, misnomer, pseudonym, aggravate, aggregation.
4. Mention and describe ten "precious stones." Describe their appearance and say where they are found.
5. Complete the following:—
(1.) You can lead a horse.....
(2.) The paths of glory.....
(3.) Cast thy bread upon.....
(4.) Authority forgets a.....
(5.) No useless coffin.....
(6.) Better fifty years of.....
(7.) If such there be.....
6. Give some account of the National Debt under these heads:
(1.) When and why it originated.
(2.) Periods of greatest increase.
(3.) Present amount, and how cost is met.
(4.) How can a country be prosperous which has an enormous debt?
7. Give a brief account of the members of our solar system.
8. How does the captain of a ship in mid-ocean determine his latitude and longitude?

Test Questions.

1. Write as specimens of copy-setting:—
Large hand.—*Impenetrability.*
Small hand.—*A little more than kin and less than kind.*
2. Analyse the following, and parse the words in italics:—

> "*No; rather* I will go to Benedick,
> And counsel him to *fight* against his passion.
> And, *truly*, I'll devise *some* honest slanders
> *To stain* my cousin *with*: one doth not know
> *How much* an ill word may empoison *liking*."

3. What are some of the commonest mistakes made by children in reading? How may they be corrected?
4. Give some account of the chief industries and towns of Asia Minor. Draw a sketch-map.
5. What inducements does Rhodesia offer to the immigrant? Mention any causes which tend to check immigration.
6. Why is Edward the First called the "English Justinian"? Show that the term is appropriate.
7. Explain clearly why Richard the Second was deposed.
8. Work the following sums:—
(*a*) Divide £10, 10s. 0d. between A and B so that $\frac{1}{2}$ of A's portion shall equal $\frac{2}{3}$ of B's. Ans. A £6; B £4, 10s. 0d.
(*b*) A sum of £3,070, 3s. 3d. has to be divided between A, B, and C, so that A may have $\frac{1}{2}$ of $\frac{2}{3}$ of B's share, B $\frac{1}{2}$ of A's and C's together. Ans. A = £202, 3s. $0\frac{4}{7}$d.
B = £1,364, 10s. 4d.
C = £1,503, 9s. $10\frac{3}{7}$d.
(*c*) A and B engage in business, their capitals being as 7 : 11. At the end of 3 months A withdraws $\frac{1}{4}$ of his capital, and one month afterwards B adds twice what A had withdrawn. How should a profit of £337, 7s. 6d. be divided at the end of the year?
Ans. A = £91, 9s. $7\frac{2}{3}\frac{1}{3}$d.; B = £245, 17s. $10\frac{8}{3}\frac{2}{7}$d.
(*d*) If $\frac{3}{4}$ of a lb. cost $\frac{1}{2}$ of a shilling, what will $\frac{2}{3}$ of a cwt. cost?
Ans. £2, 1s. $9\frac{1}{2}\frac{3}{1}$d.
9. What is meant by spectrum analysis? What do we learn from it?
10. Write a short essay on an April day.

PUPIL TEACHERS' COURSE.

For Candidates' Examination, 1904.

This month we commence a new course for those who wish to become pupil teachers on August 1, 1905. Under the present regulations the engagement will be for two years only, and the entrance examination will correspond somewhat with the old First Year Examination.

1. *Reading and Repetition.*—As considerable choice is given in these subjects, candidates would do well to select one or two books for special practice, but to read as widely as possible any good literature. While it will be necessary to commit to memory a hundred lines of standard English poetry, this should not prevent the learning by heart of any passage or poem which may be worth the effort. For reading, one of Scott's novels should be selected—for example, *Ivanhoe, The Talisman, Old Mortality,* etc. The repetition may be the special book.

2. *Penmanship.*—This is a subject which needs great care, especially with a beginner. A thoroughly good copy-book should be procured, and regular practice taken, supplemented by great care at all times. It is quite as easy to acquire a thoroughly good style of writing as it is a slipshod, bad one.

3. *English.*—For special study we recommend Scott's *Lay of the Last Minstrel.* An excellent annotated edition is published by Messrs. A. and C. Black. For this month read up the introduction, and read through the whole poem to get an idea of its subject and scope.

In grammar read up what is said on the noun in your textbook. *Nesfield's Grammar for Pupil Teachers* is strongly recommended.

4. *Geography.*—England. Coast line and physical features. (Use Blackie's *Manual of the British Isles.*) Draw maps for all the particulars; insert names, and practise till known. The geography has not been prepared properly if you cannot reproduce from memory a fairly correct map of any part.

5. *History.*—The Roman occupation of Great Britain. Note all that is said about the religion, manners, dress, etc., of the Britons, the cause of Cæsar's invasion, the steps in the conquest and the chief characters concerned therein, the results of the Roman occupation on the land and on the people, and the reasons why the Romans ultimately withdrew.

6. *Arithmetic.*—For this month go through the first four or simple rules, and make sure you understand the following points: Numeration and notation; proof of additicn by casting out nines; two methods of subtraction—decomposition and equal additions; multiplication by factors, and proof by casting out nines; division by factors, and the finding of the whole remainder from the separate remainders.

The following questions should be worked. They are samples of what may fairly be expected.

(1.) Write down in words 349687564328764571893.

(2.) Explain exactly how you would subtract 199 from 301.

(3.) What is the quickest way of working the following—369875 × 998 ?

(4.) Multiply 36834 by 729819 in three lines.

(5.) In multiplication is it necessary to commence with the units digit of the multiplier ? Multiply 54987 by 365, taking the figures in the order 6, 3, 5.

(6.) What is the remainder after the third subtraction when 123456789 is divided by 987 ?

(7.) A number is divided by the factors 7, 8, 9, and the remainders are respectively 6, 5, 4. What is the total remainder ?

(8.) A number is divided by 336 by factors 6, 7, 8. The total remainder is 315. What is the remainder from each line ?

7. *Science.*—The general properties of matter.

8. *Music.*—The names of the notes on the treble and bass staves. The tonic sol-fa names.

In addition to these subjects, every candidate should commence the study of French. Some drawing—freehand and geometry—is also desirable, and the more mathematics that can be acquired the better. A knowledge of algebra up to quadratics is of great assistance in arithmetic.

Second Year Course.

1. *Reading.*—Take regular oral practice at a special book, and read as many good books as possible.

2. *Penmanship.*—Ten minutes' practice daily. Use the same kind of pen always, and good ink.

3. *Drawing.*—One or two freehand copies per week.

4. *English.*—Goldsmith's *Traveller,* lines 51–98. Fifteen roots and meanings each week. Grammar and syntax of the pronoun.

Read the whole poem through to get an idea of the whole The author endeavours to find the country where the greatest happiness exists. With this idea he takes a survey of Italy, Switzerland, France, Holland, and Britain, notices what produces happiness in each case, and what drawbacks there are, and finally comes to the conclusion that countries and laws have little to do with man's happiness.

> "Still to ourselves in every place consigned
> Our own felicity we make or find."

5. *History.*—The Commonwealth and Charles the Second.

Cromwell's vigorous rule at home produced a state of despotism not equalled even by the arbitrary Tudors. Holding his position by the force of the army and a small section of the people—namely, the Independents—it was impossible for him to attempt any relaxation from an autocratic rule, and consequently he was forced, in self-preservation, to rule with greater harshness than Charles.

Note the reduction of Ireland and Scotland.

His foreign policy was especially spirited, and he restored England to the position it had held at the end of the reign of Elizabeth. France, Spain, Holland, the Pope, the pirates of the Mediterranean, all felt his power.

The anarchy following his death was owing to the fact that there was no one strong enough to fill his place, and the strict Puritanism of the Commonwealth gave place to the riotous debauchery of the Restoration. The joy on Charles's return was not so much personal joy at seeing him as national joy at the prospective relaxation of religious fanaticism.

The reign of Charles the Second is a very discreditable chapter in English history. Charles had all the ideas of the Stuarts, but he allowed ministers to act for him, and sacrificed them to the popular clamour as occasion needed. His policy was selfish in the extreme, but his gay and polite exterior blinded his people to the real autocrat that he was.

The Great Plague and Fire, the Clarendon Code of Laws, the Cabal Ministry, the Dutch War, the Test Act, the Popish Plot, must all be thoroughly learned.

6. *Geography.*—Africa. The Barbary States, Egypt, the Soudan, and all other parts, exclusive of the British Colonies. Use maps continually. Note particularly the peoples, productions, imports, exports, and towns. The British occupation of Egypt, its causes and results, must be studied.

7. *Arithmetic.*—Proportional parts and partnerships.

8. *Science.*—Elementary properties of oxygen, nitrogen, hydrogen, and carbon.

In dealing with each element arrange your notes under these heads :—

(1.) Atomic weight and symbol.

(2.) Occurrence in nature—free or in combination.

(3.) Methods of manufacture, with sketch of apparatus in each case.

(4.) Properties—each of which must be proved by experiment.

(5.) Chief compounds and their properties.

9. *Euclid.*—Props. 35–40, with four deductions each week.

10. *Algebra.*—Problems leading to simultaneous equations.

11. *Music.*—Continue practice in transposition.

Test Questions.

1. Write as specimen of copy-setting :—
   (*a*) Large hand.—*Advisability.*
   (*b*) Small hand.—*A bird in the hand is worth two in the bush.*

2. Analyse the following, and parse words in italics :—

> "But *me* not destined such delights *to share,*
> My *prime* of life in *wandering* spent and care,
> Impelled with steps unceasing to *pursue*
> Some fleeting good that mocks me with the view,
> My fortune leads to traverse realms *alone,*
> And *find* no spot of all the world my *own.*"

3. Explain, with examples, what is meant by nominative absolute, residual object, cognate object.

4. What is meant by the colonisation of Ulster ? What have been the effects of it ?

5. Give some account of Laud and Wentworth.

6. Draw a map of Africa, marking in the chief rivers and lakes.

7. Say what you can of the productions of the Soudan.

8. Work the following :—

(*a*) If 575 men perform a piece of work in 180 days of 10 hours each, how long will it take 115 men working 9 hours a day ?

Ans. 1,000 days.

(*b*) If a garrison of 2,800 men in 45 days, at 20 oz. each per day, consume a certain value of bread when the 4 lb. loaf is at eightpence, how many men will four times the value serve for 56 days, at 16 oz. each per day, when the same loaf is at 7½d. ?

Ans. 12,000.

OUR CERTIFICATE COURSE FOR 1904.

BY GEORGE COLLAR, B.A., B.SC.,
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TEST QUESTIONS ON LAST MONTH'S WORK.

Theory of Teaching.

1. What are the objects of "mental arithmetic"? Give examples of exercises that you would consider appropriate for each of the standards.
2. What are the difficulties that are met with in teaching percentages?
3. How would you teach children to use the smallest number of aliquot parts in working sums by practice?

English Language and Literature.

1. What are the chief characteristics of the poetry of the earlier part of the nineteenth century? Illustrate your answer by citations from the *Golden Treasury*.
2. Who were the "Lake Poets"? Say why they were so called, and mention poems in the *Golden Treasury* that illustrate the characteristics of the school.
3. Name the authors of the following extracts, and show by further quotation or reference to the context that you are acquainted with the poems from which they are taken:—

(*a*) "'Tis not because the ring they ride,
And Lindesay at the ring rides well."

(*b*) "Make me thy lyre, ev'n as the forest is:
What if my leaves are falling like its own!
The tumult of thy mighty harmonies
Will take from both a deep autumnal tone,
Sweet though in sadness."

(*c*) "I flew to the pleasant fields traversed so oft
In life's morning march, when my bosom was young."

(*d*) "How sweet on this autumnal day
The wild-wood fruits to gather,
And on my true love's forehead plant
A crest of blooming heather!"

(*e*) "Our sweetest songs are those that tell of saddest thought."

(*f*) "Take her up tenderly,
Lift her with care;
Fashioned so slenderly,
Young, and so fair!"

(*g*) "It was a childish ignorance,
But now 'tis little joy
To know I'm farther off from heaven
Than when I was a boy."

(*h*) "Lightly they'll talk of the spirit that's gone,
And o'er his cold ashes upbraid him."

(*i*) "A violet by a mossy stone
Half hidden from the eye!
Fair as a star, when only one
Is shining in the sky."

English History.

1. Describe the circumstances that led to the outbreak of war between England and France in 1793.
2. Name the chief naval engagements in the war with France (1793–1815), and state with what object each was fought.
3. What was the object of the Berlin Decree? Show why it failed.
4. Give an account of the passing of the First Reform Bill.

Geography.

1. Give an account of the lake systems of North America, naming the chief lakes and the rivers that drain them.
2. Write a short account of the Canadian Pacific Railway.
3. Mention any peculiarities in the climate of North America, and give an explanation of them as far as you can.

Arithmetic.

1. A watch which is set correctly at noon indicates 10 minutes past nine the same evening when the true time is 10. What is the true time when the watch indicates 11 the same evening?
2. The breadth of a rectangular field is $\frac{3}{4}$ of its length, and its area is 405,741 square yards. Find the sides.
3. How can I divide 5 half-crowns, 6 florins, and 29 sixpences between two people so that each person shall have the same amount and also the same number of coins?

Algebra.

1. A train which travels 8 miles an hour faster than another performs a journey of 212½ miles in four hours less time. Find the speed of each train.
2. Establish the following identities:—

(*a*) $(n-r)\{3(n-r+1)+2(2r-n)\} = (n+1)(n+2) - (r+1)(r+2)$.

(*b*) $\dfrac{b-c}{a^2-(b-c)^2} + \dfrac{c-a}{b^2-(c-a)^2} + \dfrac{a-b}{c^2-(a-b)^2} = 0.$

3. Solve the equations:—

(i) $108x^2 - 745x + 108 = 0$,

(ii) $\sqrt{1+x} - \sqrt{2+x} = 2\sqrt{3+x}$,

and verify the results you obtain.

Geometry.

1. The straight lines drawn from the vertices A and B of a triangle ABC perpendicular to the opposite sides intersect in O. Show that CO produced will meet AB at right angles.
2. A piece of cardboard 5 inches square is lying on a table with one corner A at the edge of the table and another corner B 3 inches from the edge. Prove that the distance of C from the edge is the sum of the distances of B and D, and find how many inches it is.

Elementary Science.

1. Describe the stomach of a rabbit or of a sheep, and give an account of the digestive changes which take place there.
2. What is glycogen? Why is it not to be found in the liver of an animal that has been dead for some hours, and of what use is it in the animal economy?

NOTES AND SYLLABUS FOR MAY.

English Composition.

Prepare essays on the following subjects:—

1. Wild flowers.
2. Gardening.
3. Nature study.
4. "Where ignorance is bliss
'Tis folly to be wise."
5. The life and character of Napoleon the First.

Theory of Teaching.

Finish the text-book. The chapter on object lessons and elementary science should receive special attention, owing to the importance attached to nature study at the present time.

It is very difficult to draw a line between object lessons or nature study on the one hand, and elementary science lessons on the other. The aim of Froebel and those who introduced object lessons was not so much to impart information as to train the children in correct habits of observation. The object was to be set before them, and they were to put questions to it, and learn from it—not to be told facts about it by the teacher. If the lesson were satisfactorily given, the children would acquire an increase of power of observation and of formulation; for they must be taught to record, or at least to state, the results of their observations. At the same time it is almost impossible for a child to have such a lesson without gaining some new information. But the information is not the chief thing sought after. On the other hand, in an elementary science lesson the information is in itself the most important thing, though it cannot be the only thing; for if the lesson is properly given, the children should be required to find out as much as possible for themselves, and the teacher will seize every opportunity that may arise for improving the child's mental powers. Nature study may be included under either heading; for if a natural object is presented to the class, and the children make their own observations upon it, the lesson is an object lesson. But if the teacher's main purpose is to impart information about the object, or if he uses the object as a peg on which to hang information about other things, then, if the information is exact and precise, the lesson is an elementary science lesson. It follows, therefore, that the difference between object lessons, nature study, and elementary science is really one of degree, with the exception, of course, that nature study deals with natural objects alone, while object lessons may include manufactured articles, and elementary science may deal with artificial bodies and experimental changes. Lessons in all three

groups lend themselves to other objects besides their primary ones. In nature study the opportunity should be embraced of inculcating a love of nature and the duty of kindness to animals, and in all three groups efforts should be made to develop the powers of composition, oral or mental, according to the ages of the children.

The chapter on writing is important, in spite of the fact that far less attention is paid to penmanship than was formerly the case. Notice the essentials of good writing, see how the requirement of speed seems to be opposed to that of beauty and even of legibility, and observe how a compromise may be effected. Be prepared to answer questions on the respective advantages of teaching by means of the blackboard, copy-books with headlines, and copy-books without headlines.

The importance of drawing is now universally recognized, and the following question from the Certificate Examination shows what is required of the student :—"The new Code attaches special and increased importance to the study of drawing in schools. Describe some of the earliest exercises which should be given in drawing, and say in what relation they stand to a good and complete course of general education."

The other two subjects remaining to be treated are music and physical exercises. Concerning the former we have nothing to add to what is set out in the chapter. The importance of physical exercises in schools has risen to such a point that there is almost sure to be a question on this subject at the examination. The question last year was : "How would you judge of the merits of a lesson in physical exercises given to a class of 40 or 50 children in a primary school ? Mention some of the commonest faults in such lessons."

English Literature.

Study the *Papers from the "Spectator."* These are generally credited to Addison, but they were written with the help of his friend Richard Steele, who, however, had less to do with the Sir Roger de Coverley section than with the rest of the papers published in the *Spectator*. Steele and Addison had been running a paper called the *Tatler;* but owing to political opinions expressed in it Steele lost an appointment he held, and the paper came to an end on January 2, 1711. On the 1st of March following Steele issued the first number of the *Spectator*, and Addison gave him his hearty support and co-operation. For nearly eighteen months the *Spectator* was published daily for one penny, and its sale had got as high as fourteen thousand. Then a stamp duty of a halfpenny was imposed on all newspapers, and many of the rivals of the *Spectator* were obliged to succumb. Steele, however, decided to raise the price to twopence, and try to improve the quality; and he succeeded in keeping the journal going until December 6, 1712, when it came to an end without notice. Addison's papers possessed a great charm, and have always been regarded as models of good English prose. They are marked with a peculiar quiet humour, free from smart wit or boisterous ridicule, and display a carefully-balanced criticism on men and things. Addison is sometimes said to have popularised Milton's *Paradise Lost* by his series of eighteen papers on the subject. These were, with one exception, written for the Saturday issue of the *Spectator*, which was generally of a more serious turn than that issued on the other days of the week, as it was intended to provide material for reading on the Sunday. Another excellent series of contributions by Addison was the set on the pleasures of the imagination. Taking the syllabus literally, we presume that the student is expected to read only those of the Coverley papers that were written by Addison, not those by Steele. We should, however, strongly recommend the student to read them all, since the papers by Steele are necessary for the appreciation of the set as a whole. Special attention should, of course, be given to those that were written by Addison, and a short summary or running analysis of each should be made. The following are the papers contributed by Addison :—Coverley Hall, or Sir Roger at Home; The Coverley Guest, or Sir Roger and Will Wimble; The Coverley Ghost; The Coverley Sabbath, or Sir Roger at Church; The Coverley Hunt (incomplete); The Coverley Witch, or Sir Roger and the Witches; The Coverley Etiquette; The Coverley Ducks; Sir Roger on the Bench, or Sir Roger at the Assizes; The Story of an Heir; Sir Roger and Party Spirit; The Coverley Gipsies, or Sir Roger and the Gipsies; A Summons to Town; Sir Roger in London, or Sir Roger in Town; Sir Roger in Westminster Abbey; Sir Roger at the Play; Sir Roger at Vauxhall; Sir Roger passeth away, or The Death of Sir Roger. We have given alternative titles to these papers, because in some editions they are denoted by one and in other editions by the other.

The *Tour to the Hebrides* should be revised this month, as should also the weak parts in the rest of the work.

English History.

Study the reign of Queen Victoria. In addition to the section given in the text-book, the student should read Justin M'Carthy's *Short History of our own Times*, or Dr. Bright's *History of England*, Periods IV. and V. The nearer we get to our own times the more difficult does it become to separate history from party politics. In one way this is an advantage, for the reader may regard the different ministries as convenient epochs into which to divide the reign. There are many important movements to study which went on steadily despite changes of government, and many important reforms introduced which seem to have been independent of party. Public support of education is one of the features of this reign, although the first parliamentary grant for education was made in 1833. In that year an annual grant of £20,000 was instituted to assist in the building of school-houses. In 1839 this was increased to £30,000, and the Committee of the Privy Council on Education was set up. This committee continued to manage education until 1899, when the Board of Education was introduced. Three training colleges—Battersea, Borough Road, and St. Mark's—were founded in 1840. The Revised Code was introduced by Mr. Lowe in 1862, and in 1870 Mr. Forster introduced the Education Act that set up School Boards and made education compulsory. After a Royal Commission had sat to inquire into the needs, the Technical Instruction Act was passed in 1889. The Act of 1901, as well as that of 1902, extending the general principles to London, belongs of course, to the present reign, but both should be taken in connection with the general progress in the subject.

The extension of the use of steam power and electricity as means of trade and communication requires attention, since the extraordinary development of commerce is one of the most noteworthy features in Victoria's reign. The various movements to improve the condition of the poor must be considered, as must also the relations between Great Britain and Ireland. A question, too, that requires careful consideration is that of the removal of restrictions on trade, since it is occupying so much attention at the present time among politicians. This is best studied in connection with the abolition of the Corn Laws in 1846. Affairs in India, South Africa, Egypt, and Australia all combine to increase the amount of work that the student must undertake in mastering this important reign.

Geography.

Study the geography of Australasia. The physical features are generally well described in the text-books, but the productions and commerce are rarely up to date. This is hardly to be wondered at, seeing the rapid rate at which they have increased. The trade of New Zealand has increased fiftyfold since 1852, and the trade of Australia over fifteenfold. Australia is now the greatest sheep and wool producing country in the world, and exports about half a billion pounds of wool every year. One has only to look at a catalogue of the sales at the London Wool Exchange to see that about three-quarters of the wool used in England comes from Australia; large quantities are also re-exported to the Continent. There is also a large export of hides, leather, frozen meats, dairy produce, and tallow; also of grain, wine, and fruit—particularly apples from Tasmania. Western Australia is now the chief section for exporting gold, the amount found in the other colonies having fallen off. New South Wales raises about 4,000,000 tons of coal a year, much of it being sent to the south coast of Asia, and even to California; iron is also being worked in increasing quantities. Tin is produced in Tasmania. Under the protection of high import duties manufactures are developing, but not yet sufficiently to supply the home wants of the colonies. The chief are agricultural and other machinery, leather, soap, candles, sugar, beer, wine, and brandy. New Zealand exports chiefly refrigerated beef and mutton, wool and dairy produce, also wheat, grass seeds, gums, and flax. Manufactures, like those of Australia, are increasing, but do not nearly meet home requirements.

The Far East is at present a centre of attention, and the geography of Japan, China (particularly Manchuria), and Korea should be studied. See also the account of the Trans-Siberian Railway in one of our recent numbers. Notice how Japan has come to the front as a manufacturing and commercial nation. During the last twenty years her foreign trade has increased eightfold, the greater part of this increase having taken place since the war with China in 1894–5. Cotton-spinning has been introduced, and there are now about 2,000,000 spindles at work. These supply thousands of handlooms in the country. The woollen industry has sprung up, and the old-established silk industry has received a great impetus by the adoption of European methods. The textiles are now worth about £40,000,000 per annum. Shipbuilding is making great progress; most of the smaller craft engaged in the present war were built in Japan, and the Japanese hope in a few years to build their own battleships. Japan also produces leather goods, glassware, watches, clocks, and mathematical instruments. Among the mineral

products are kaolin or china-clay of a superior quality, coal, and copper, besides an increasing quantity of petroleum. The largest copper mines of Asia are in Japan, which now ranks third among copper-producing countries. Other metals are found, including silver, gold, lead, antimony, and iron, although the latter is somewhat scarce. Japan is, however, essentially an agricultural country, and produces raw silk, tea, rice, corn, and fruit. In the island of Formosa, which now belongs to Japan, are produced tea, rice, and sugar, besides about five-sixths of the world's supply of camphor. There are in Japan about 4,000 miles of railway, and thousands of miles of telephone and telegraph wires. The war navy ranks sixth or seventh among the navies of the world, and her mercantile marine comprises 1,100 steamers of European type, including the splendid liners of the Japan Mail Company (Nippon Yusen Kaisha), and 1,900 sailing vessels of European type, and about ten times as many smaller native vessels. The war of 1894–5 greatly increased the respect of the Chinese for Japan, and there seems to be a natural tendency to an alliance between these two Mongolian empires, which will probably put an end to the extension of Russian power in the East.

The geography syllabus is a very wide one, and much revision is necessary.

Arithmetic.

The following problems were set last year in the Certificate Examination at one of the training colleges:—

1. Prove that when a number is divided by nine the remainder is the same as when the sum of the digits is divided by nine.

Hence show how to test the correctness of the division $2950 \div 44 = 67 + \frac{2}{44}$. What does this test really prove as to the difference between the dividend and the quotient × divisor + remainder?

The first part of this question is fully dealt with on page 70 (§ 5) of Christian and Collar's Arithmetic.

The proof of an example in division depends upon the fact that division is the converse of multiplication, for the quotient multiplied by the divisor is equal to the dividend diminished by the remainder. That is

$$44 \times 67 = 2950 - 2.$$

Now 44 = a number of nines + 8, as proved.

67 = a number of nines + 4.

$\therefore (9m + 8) \times (9n + 4) = 9 \times 9 \times m \times n + 8 \times 9n + 4 \times 9m + 8 \times 4.$

The first three terms are multiples of nine, and the last, 32, $= 3 \times 9 + 5$ consequently the whole is equal to a multiple of 9, plus 5.

But since 2950 = a number of nines + 7 (by proof), $\therefore$ 2950 − 2 = a number of nines + 5.

This test does not prove the absolute correctness of the sum, although the remainders are identical, because there might be an error in the number of nines. In answer to the last part of the question (which is not very clearly stated), we should say that the test proves that the difference between the dividend and the quotient × divisor + remainder is *nil*.

2. A reservoir is supplied by three pipes, A, B, C, which discharge respectively 19, $8\frac{1}{2}$, and 9 gallons a minute. It is found that A and B together can raise the level of the water 7 ft. in 42 minutes, and that if A, B, and C work together the level can be raised 10 ft. 8 in. in 48 minutes. Show that there is a leak in the reservoir, and find the quantity that escapes per minute, assuming the leak to be at the bottom of the reservoir.

The student is expected to assume two things—(*a*) that the surface of the water is constant, which would not be the case if the reservoir were in the form of an inverted funnel. If the surface is not constant, the conditions might be fulfilled without a leak in the bottom. (*b*) That the water escapes at a *uniform* rate through the leak at the bottom—an assumption which would be made only by a person ignorant of hydrostatics.

A and B would raise the level $\frac{1}{4}\frac{1}{2}$ of 7 ft. in 48 minutes—that is 8 ft.

During the 48 minutes C alone should raise it $\frac{9}{19 + 8\frac{1}{2}}$ of 8 ft. higher still—that is, $2\frac{2}{5}\frac{5}{5}$ ft.; but it does actually raise it $2\frac{3}{4}$ ft., a difference of $\frac{3}{4} - \frac{2}{5}\frac{5}{5}$ ft. or $\frac{1}{2}\frac{1}{0}$ ft. Therefore all the water supplied by A and B has not been used in raising the height of the water—that is, there is probably a leak.

Now since C alone raises the level $2\frac{3}{4}$ ft. in 48 minutes, or $\frac{1}{1}\frac{1}{9}\frac{1}{2}$ ft. per minute, A and B should raise it $\frac{19 + 8\frac{1}{2}}{9}$ of $\frac{1}{1}\frac{1}{9}\frac{1}{2}$ ft. per minute—that is, $\frac{55 \times 11}{18 \times 192}$ ft. per minute; but they actually raise it $\frac{1}{6}$ ft. The quantity lost is therefore—

$$\left(\frac{55 \times 11}{18 \times 192} - \frac{1}{6}\right) \text{ of } (19 + 8\tfrac{1}{2}) \text{ gallons per minute.}$$

$$\frac{605 - 576}{18 \times 192} \text{ of } \frac{55}{2} \text{ gallons} = \frac{29 \times 55}{18 \times 192 \times 2} \text{ gallons.}$$

Ans. $\frac{1695}{6912}$ gallon.

3. A merchant dilutes a cask of spirits with water, and sells the mixture at the same price per gallon as he had paid for the undiluted spirit. If he made 15 per cent. profit on the transaction, find to three places of decimals the number of gallons of water in an 18-gallon cask of the mixture.

This is easy enough to those who will only remember that a percentage is a ratio, or abstract number, and is meaningless unless joined to a concrete quantity, expressed or understood. The phrase "15 per cent. profit" means "15% of the cost price" profit. The careless student is apt to say that to make this profit he must add "15 per cent. water." True; but 15% of what? The water added must be 15 per cent. *of the number of gallons of undiluted spirit taken.* If he takes 100 gallons of spirit, he sells 115 gallons of the mixture; so there are 15 gallons of water in every 115 gallons (not 100 gallons) of mixture. Therefore in an 18-gallon cask there will be $\frac{1}{1}\frac{5}{1}\frac{5}{5}$ of 18 gallons.

$$\frac{1}{1}\frac{5}{1}\frac{5}{5} \text{ of } 18 = \frac{3}{1}\frac{5}{3} \times 18 = \frac{4}{1}\frac{4}{2} = 2{\cdot}347.$$

Ans. 2·347 gallons.

Algebra.

Revise the back work, paying special attention to theory of quadratics, ratio and proportion, and work plenty of problems.

Euclid.

Revise the text and work deductions. Send up difficulties.

Elementary Science.

Revise back work, and in the biological part pay special attention to the relation between structure and conditions of life.

ZOOLOGICAL SOCIETY OF LONDON.

The Zoological Society is anxious to make the gardens as useful as possible for teachers, and has accordingly arranged reduced terms of admission for schools and excursion parties. There are few places that combine pleasure with instruction to the same extent as the society's gardens.

The following reduced prices for excursion tickets for parties of not less than fifty for any fixed date (except Sunday) are now in operation, namely:—

Adults.	Children under 12 Years.
50 to 100 at 9d. each.	50 to 100 at 5d. each.
101 to 250 at 8d. each.	101 to 250 at 4d. each.
251 to 500 at 7d. each.	251 and upwards at 3d. each.
501 and upwards at 6d. each.	

If the date fixed for the proposed visit to the gardens should, through unforeseen circumstances, be found unsuitable, the tickets, upon being returned to the office, may be endorsed for another day during the year of issue.

Special packets of school excursion tickets, for the admission of 25 school children (under 14 years of age) and one teacher, may now be obtained for any fixed date (except Sunday) at the Society's Office, 3 Hanover Square, W., at the reduced price of eleven shillings (11s) per packet.

The Board of Education has now definitely decided not to print the Official Register of Teachers, owing to the great expense of printing the list of the 80,000 elementary teachers in Column A of the Register. The editor of the *Schoolmaster's Yearbook* has, however, decided to publish the list of secondary teachers, masters and mistresses, in Column B. The list, which will be correct up to March 31, 1904, will contain some 5,400 entries, with the particulars recorded in the official register. It will be published shortly by Messrs. Swan Sonnenschein.

University of Oxford School of Geography. — Notice of Long Vacation Course.—A vacation course in geography, similar to that of August 1902, will be held at the School of Geography, Oxford, during the first sixteen days of August 1904, provided that a sufficient number of students send in their names to the Curator, School of Geography, Oxford, by June 1st. It is proposed to have courses of lectures, probably on the British Isles and on the principles of geography applied to education, and in addition to have classes for practical work both in and out of doors. A number of excursions will be arranged. The fee will be £3, 3s., and this will include the use of apparatus for the practical classes.

A provisional programme will be sent in May to all who forward a stamped addressed envelope to the Curator, School of Geography, Broad Street, Oxford.

OUR SCIENCE SECTION

☞ **Subscribers requiring Explanations of Difficulties in any branch of Science, or Advice upon Courses of Study, can obtain all help required by communicating with the Editor, and accompanying their query with the Coupon cut from this Number.**

CHEMISTRY.

(ADVANCED AND HONOURS.)

BY C. A. WEST, B.SC., A.R.C.S., F.I.C.

Relation between Atomic Weights and Spectra of some Elements.—W. Marshal Watts (*Phil. Mag.*, 1903) points out the fact that there are apparently two kinds of connection between the spectra of allied elements. In the first case, of which the zinc, cadmium, and mercury family are an example, the differences between the vibration frequencies of certain lines in the case of one element are to the differences between the frequencies of the corresponding lines of the second element in the same ratio as the squares of the atomic weights. In the second case, of which the barium, strontium, and calcium group is an example, the element of the greatest atomic weight has the smallest frequency, and if a corresponding line is taken in the spectra of three elements, the differences of the frequencies are in the same ratio as the differences between the squares of the atomic weights. In the first case the atomic weight of one element can be calculated from that of the other. For instance, assuming the atomic weight of cadmium, and calculating the atomic weight of zinc from this by taking the frequencies of twenty-four corresponding lines in the two spectra, we get values for the atomic weight of zinc ranging from 64·69 to 65·69. In the same way, calculating the atomic weight of cadmium from that of mercury, the values obtained range from 110 to 113. In the second case the atomic weight of an element may be calculated if we assume the atomic weights of two others, and assume the correspondence of the lines. In this way values varying from 87·2 to 87·8 were obtained for the atomic weight of strontium. In the same way, by comparing the lines of potassium, rubidium, and cæsium, the values obtained for the atomic weight of rubidium varied from 83 to 86·8.

Constancy of Faraday's Law.—It has been shown by W. Richards and W. N. Stall that when the same current is passed through two electrolytic cells in series, one containing silver nitrate dissolved in water at 20° C. and the other containing silver nitrate dissolved in fused sodium and potassium nitrates at 250° C., the amounts of silver deposited are the same in the two cells to within 0·005 per cent. In this way they have proved that the validity of Faraday's law is independent of the temperature and of the nature of the solvent.

Relation of Specific Heat to Atomic Weight.—Prof. W. A. Tilden, in the *Proceedings of the Royal Society for 1903*, gives the results of a number of determinations of the specific heats of pure aluminium, nickel, cobalt, silver, and platinum for several ranges of temperatures.

Range.	Aluminium.	Nickel.	Cobalt.	Silver.	Platinum.
−182° to +15°	0·1677	0·0838	0·0822	0·0519	0·0292
−78 „ +15	0·1984	0·0975	0·0939	0·0550	—
+15 „ 100	—	0·1084	0·1030	0·0558	0·0315
15 „ 185	0·2189	0·1161	0·1047	0·0561	—
15 „ 335	0·2247	—	—	—	—
15 „ 350	—	0·1186	0·1087	0·0576	—
15 „ 435	0·2356	0·1240	0·1147	0·0581	0·0338
15 „ 550	—	0·1240	0·1209	—	—
15 „ 630	—	0·1246	0·1234	—	—

From the above results the specific heats at successive temperatures on the absolute scale have been calculated. The results do not agree with the assumption of a constant atomic heat at absolute zero.

The values of the mean specific heats of silver sulphide and nickel sulphide were found to be as follows:—

Range.	Nickel Sulphide.	Silver Sulphide.
−182° to +15°	0·0972	0·0568
15 „ 100	0·1248	0·0737
15 „ 324	0·1383	0·0903

Baths for Melting-point Determinations.—Heyward Scudder, in the *Journal of the American Chemical Society*, recommends the following baths for melting-point determinations:—

1. A bath prepared by boiling seven parts by weight of sulphuric acid of specific gravity 1·84 with three parts of potassium sulphate for five minutes. This can be heated to 325° without boiling.

2. For higher temperatures, from 360° to 600°, fused zinc chloride works well.

Lecture Experiments to Demonstrate the Law of Mass Action.—Prepare a $\frac{N}{1000}$ solution of potassium hydroxide, and add phenolphthalein. If this solution be shaken with mercurous chloride, the red colour disappears through neutralisation, and grey mercurous hydroxide is formed ($HgCl + OH' = HgOH + Cl'$). If a $\frac{N}{100}$ solution of potassium hydroxide is used instead of a $\frac{N}{1000}$ solution, the mercurous chloride becomes grey. The red colour, however, is not destroyed, because the chlorine ions reach such a concentration that the above reaction is reversed. Adding potassium chloride produces the same effect on the $\frac{N}{1000}$ solution of potassium hydroxide. On adding a few drops of a saturated solution of potassium chloride to the solution of dilute potassium hydroxide solution which has been shaken with mercurous chloride, the red colour is reproduced. A mixture of equal volumes of $\frac{N}{100}$ potassium hydroxide solution and saturated potassium chloride solution has no action on mercurous chloride, which remains white.

If any of the solutions to which mercurous chloride has been added without causing the disappearance of the red colour of the phenolphthalein be warmed, the red colour disappears, and reappears on cooling.

Preparation of Hydrogen Sulphide in the Dry Way.—E. Prothière (*Chem. Cent.*, 1903, i. p. 492) states that by heating 30 grams of vaseline with 70 grams of sulphur a volume of 48·18 litres of hydrogen sulphide may be produced.

Electrolytic Peroxides of Lead, Nickel, and Bismuth.—(Auguste Hollard, *Compt. Rend.*, 1903, p. 136). It is found that during the electrolysis of a solution of a lead salt the weight of the deposit on the anode is greater than corresponds to the formula PbO_2. This is probably due to the formation of a higher oxide containing more oxygen than the dioxide. The less the concentration of the solution, the greater the proportion of this higher oxide. In the experiments 300 c.c. of a solution of lead nitrate were used, containing 0·0106 to 10 grams; a little excess of nitric acid, and also copper nitrate corresponding to 10 grams of copper, were also present. The anode used was of platinised platinum gauze. In the case of the most dilute solution the factor was 0·740, and rose to 0·861 in the case of the most concentrated solution. In the electrolysis of a moderately concentrated solution of a lead salt, lead dioxide appears to be first formed, and this is then covered by a layer of one or more higher oxides as the concentration of the solution decreases.

When a nickel solution (0·05 gram in 300 c.c.) containing chromic acid and alkali pyrophosphate was electrolysed at 70° for fifty-four hours with a current of 0·1 ampère, the peroxide NiO_4 was formed. In the case of bismuth sulphate (0·05 gram of bismuth for 300 c.c.) containing excess of nitric acid, and also copper sulphate (40 grams), a peroxide, Bi_2O_7, was deposited as a citron-yellow powder.

PHYSIOGRAPHY.

(STAGES 2 AND 3.)

MINERALS OF THE IGNEOUS ROCKS.

(Continued.)

THE **Olivine** group comprises olivine and serpentine, common constituents of the basic rocks.

Olivine, $(Mg, Fe)_2SiO_4$, is a basic silicate of magnesium, but contains some iron. It crystallises in the rhombic system. It occurs in granules or in nearly rectangular crystals which, when fresh, have a yellow-green colour, due to iron, and look much like glass.

Olivine, however, readily undergoes decomposition, and loses its lustre. The chief decomposition product is serpentine, which is comparatively soft and dull. Magnetite is also very often one of the decomposition products, and sometimes renders the partly decomposed olivine black. In microscopic sections fresh olivine looks very much like quartz, but is distinguished from it by its strongly-pitted appearance, due to its high refractive index, 1·68. Perfect crystals are seldom found, but they generally show an elongated hexagonal section. Decomposition products are usually shown, the decomposition starting along cracks, and extending inwards so as to enclose more or less colourless areas. The decomposition products are serpentines and magnetite. The polarisation colours are usually pale and delicate.

Serpentine, $H_4(Mg, Fe)_2Si_2O_9$, is a hydrated basic silicate of iron and magnesium, belonging to the rhombic system. As before stated, it frequently occurs as a decomposition product of olivine. It is usually crypto-crystalline or amorphous, and varies in colour from blue-green to yellow. Its hardness is only 3. It is pleochroic, changing from one shade of green to another. In polarised light it generally appears as an aggregate of minute crystals.

In addition to the minerals already described there are many others, but most of them must be looked upon as accessory and secondary minerals, and not of importance as rock-forming minerals. Several important oxides, however, occur, and these deserve some attention.

THE OXIDES.

The most important of the rock-forming oxides is quartz or dioxide of silicon. This is so important that it is usually put in a class by itself. Other important oxides are magnetite, hæmatite, and ilmenite.

Magnetite, Fe_3O_4, belongs to the cubic system. It occurs as black octahedra, or grains. It seems to be quite opaque, even in very thin microscopic sections. It occurs plentifully as a decomposition product, especially of hornblende and olivine.

Hæmatite, Fe_2O_3, belongs to the hexagonal system. By reflected light it shows a characteristic red colour. In microscopic sections it appears in orange-red plates or patches. It is formed when magnetite decomposes.

Ilmenite, $mTiFeO_3 + nFe_2O_3$, belongs to the hexagonal system. It is an oxide of titanium and iron, and looks much like magnetite.

CLASSIFICATION OF THE IGNEOUS ROCKS.

The modern classification of igneous rocks is based upon their chemical composition, upon their structure, and upon the extent of their crystallisation. As we have seen, silica enters into the composition of the majority of minerals, and therefore into that of the rocks composed of them. Hence it has become customary to group the igneous rocks according to the percentage of silica which they contain. Where the percentage of silica is very high, free silica (quartz) is always present. Rocks containing 65 to 80 per cent. of silica are classed as acid rocks, those containing 55 to 65 per cent. as intermediate rocks, those containing 45 to 55 per cent. as basic, and those containing less than 45 per cent. as ultra-basic rocks.

When the rocks consist of comparatively loose pieces, or of masses which are not very compact, as in the case of pumice, they are spoken of as fragmentary. When the rock has been fused and cooled too quickly to allow of crystallisation taking place, we get glassy forms. In some glassy forms we see small crystallites, indicating the setting in of crystallisation before the mass solidified. When the cooling process has been somewhat slower, a number of distinct crystals may be seen set in a glassy base and mixed with crystallites. Such a structure is called a crypto-crystalline structure. When there is no glass present, and larger crystals appear set in a base composed of small crystals or crystalline granules, the structure is spoken of as micro-crystalline. When the rock shows a very distinct crystalline structure throughout, the structure is spoken of as holo-crystalline. The following classification of the more common igneous rocks is based on their structure, on the percentage of silica they contain, and to some extent on the minerals present.

TABLE FOR THE IDENTIFICATION OF COMMON IGNEOUS ROCKS.

Percentage of Silica.		Acid, 65 to 80 per cent.	Intermediate, 55 to 65 per cent.				Basic, 45 to 55 per cent.	Ultra-basic, under 45 %.
Characteristic Mineral.		Quartz.	Orthoclase Felspar.		Plagioclase Felspar.		Olivine.	
			Felspathoids absent.	Felspathoids present.	Felspathoids absent.	Felspathoids present.		
VOLCANIC. Result from rapid cooling under little pressure.	Fragmentary.	*Ash.* *Rhyolite tuff.* *Pumice.*	*Ash.* *Trachyte tuff.* *Pumice.*	*Ash.* *Pumice.*	*Ash.* *Pumice.*	*Ash.* *Pumice.*	*Ash.* *Scoria* and *Lapilli.*	*Pele's Hair.*
	Glassy.	*Obsidian.* *Pitchstone.* (Devitrified obsidian.)	*Obsidian.* *Pitchstone.*	(Rare.)	*Andesite glass.* (Rare.)	(Rare.)	*Tachylyte.* *Limburgite.*	Percentage of silica too low to admit of formation of glass.
	Crypto-crystalline.	*Rhyolite.* (Q.O.M., if developed, set in a crypto-crystalline base.)	*Trachyte.* (O.H. in a micro- or crypto-crystalline base.)	*Phonolite.* (O.H.N.)	*Andesite.* (P.H.)	*Tephrite.* (P.H.N.)	*Basalt.* (P.Au.Ol.)	
	Altered forms.				*Porphyrite.* (Altered andesite.)		*Melaphyre.* (Altered basalt.)	*Serpentine.*
PLUTONIC. Result from slow cooling. No glass.	Micro-crystalline.	*Quartz-Felsite.* (Q.O.M. set in a micro-crystalline base.)					*Dolerite.* (P.Au.Ol.)	*Teschenite.* (P.Au.H.)
	Holo-crystalline.	Varieties of *Granite.* (Typically Q.O.M.) Greisen (Q.M.). Aplite (Q.O.).	Varieties of *Syenite.* (O.H.)	*Elæolite-Syenite.* (O.H.El., etc.)	Varieties of *Diorite.* (P.H. or P.Au.)	*Theralite.* (P.H.El. or P.Au.El.)	Varieties of *Gabbro.* (P.Ol. Diallage.)	
	Altered forms.				*Epidiorite.* (Altered diorite.)		*Diabase.* (Altered Dolerite.) *Serpentine.*	*Serpentine.*

In above table Q = Quartz, O = Orthoclase, M = Mica, P = Plagioclase, H = Hornblende, Au = Augite, N = Nepheline, El = Elæolite, Ol = Olivine.

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THEORETICAL MECHANICS.

(ADVANCED AND HONOURS STAGES.)

BY FRANK CASTLE, M.I.M.E.,

Royal College of Science; Lecturer on Mechanics, etc., Morley College, London; Author of "Elementary Practical Physics," "Practical Mathematics," etc.

Measurement of Work.—In problems dealing with the work done by a force, it is advisable to use graphical methods as frequently as possible. These not only tend to prevent mistakes, but also usually indicate clearly the various steps in a solution. Familiar cases will probably at once occur to the reader. Among these a few may be cited here. Thus the work done by a constant force P, acting through a distance S, is given by the product PS, and may be represented by the area of a rectangle in which the base denotes the numerical value of S, and the adjacent side the value of P. In compressing a spring the force P may vary from zero to a maximum value, so that if x denotes the distance through which the spring is compressed, then the average force is $P \div 2$, and the work done is given by $Px \div 2$. This may be appropriately represented by the area of a right-angled triangle, the base being x and the perpendicular equal to P. Again, in problems dealing with perforation, the assumption is usually made that the average force or resistance, multiplied by the distance through which it acts, is the work done by the force. This is the case in such problems as the penetration of a nail into a block of wood when struck by a hammer, the penetration of a pile under the action of a pile-driver, the perforation by a bullet, etc. Still another familiar example of the work done by a variable force is furnished by the pressure of the gas forcing a piston along a cylinder. Assuming the temperature of the gas to remain constant, then the work done is given by $PV \log_e r$, where r denotes the ratio V_1/V. P being the initial pressure, and V and V^1 the initial and final volumes of the gas respectively, the diagram representing the work done is a portion of a rectangular hyperbola.

If, in addition to the preceding, the fundamental equations of energy and momentum are clearly made out, then no difficulty will be experienced when dealing with problems or exercises. These may be obtained from any text-book on the subject, or the reader may with advantage refer to previous issues of the *Practical Teacher*. The following are a few typical cases:—

Ex. 1. Explain the measurement of work (i) when done by a constant force, (ii) when done by a variable force, giving graphical illustrations.

Determine the horse-power of a river at a place where the breadth is 70 yards, the mean depth 10 feet, and the mean velocity 4½ miles per hour. Assume a cubic foot of water to weigh 62·5 lbs. (Inter., 1900.)

$$4\tfrac{1}{2} \text{ miles per hour} = \frac{4{\cdot}5 \times 5280}{60} = 396 \text{ ft. per minute.}$$

The volume of water in one foot length will be $70 \times 3 \times 10$ cubic feet $= 2100$ cubic feet.

Weight of water $= 2100 \times 62{\cdot}5$ lbs.

Work done $= 2100 \times 62{\cdot}5 \times 396$ ft. lbs. per minute.

$$\text{Horse-power} = \frac{2100 \times 62{\cdot}5 \times 396}{33000} = 1575.$$

Ex. 2. Illustrate the convertibility of work and kinetic energy by reference to some simple familiar examples.

The range of a gun is to be 20 miles. The shot weighs one ton, and its velocity is 1840 feet per second. Determine the charge of powder required, assuming the strength of the powder capable of realising 100 foot tons per pound of powder. (Inter., 1901.)

The kinetic energy of the shot will be

$$\tfrac{1}{2}Mv^2 = \frac{1 \times (1840)^2}{64} \text{ foot tons.}$$

As each pound of powder represents 100 ft. tons of energy, therefore, if n denotes the number of pounds of powder required, then $n \times 100 = \dfrac{1 \times (1840)^2}{64}$.

$$\therefore n = \frac{(1840)^2}{6400} = 528{\cdot}9 \text{ lbs.}$$

Ex. 3. Prove that an interchange, without loss, of momentum takes place in the collision of bodies, but that there is in general a dissipation of energy.

If a bullet weighing w lbs. is fired with velocity v at a body weighing W lbs., advancing with velocity V, the body will retain the velocity

$$\frac{WV - wv}{W + w}, \text{ or } V - \frac{w}{W}(v - u),$$

according as the bullet is embedded, or perforates and retains a velocity u.

Calculate the energy liberated, and thence infer the average resistance of the body from the length perforated by the bullet. (Inter., 1902.)

The momentum of the bullet will be $\dfrac{wv}{g}$.

The momentum of the body $\dfrac{WV}{g}$.

If U denotes the velocity with which the body moves when the bullet is embedded, then we obtain the relation

$$\frac{W + w}{g}U = \frac{WV - wv}{g}.$$

$$U = \frac{WV - wv}{W + w}.$$

In case of perforation the change of momentum will be given by

$$\frac{WV}{g} - \frac{w}{g}(v - u).$$

Hence, if U denotes the velocity of the body, then

$$\frac{W}{g}U = \frac{WV}{g} - \frac{w}{g}(v - u), \text{ or } U = V - \frac{w}{W}(v - u).$$

Ex. 4. Prove the dynamical formulae

$$\text{(i) } Pt = \frac{Wv}{g} - \frac{WV}{g}. \quad \text{(ii) } Ps = \frac{Wv^2}{2g} - \frac{WV^2}{2g},$$

explaining the notation.

Calculate the time and distance in which the velocity of a 100 lb. shot will fall from 2010 to 1990 *f.s.*, against an average air resistance of 800 pounds, neglecting gravity. (Inter., 1903.)

For proof, see text-book.

$$\text{Change of momentum} = \frac{100}{g}(2010 - 1990) = \frac{100 \times 20}{32}.$$

$$\therefore \text{ from (i), } 800 \times t = \frac{100 \times 20}{32}.$$

$$\text{Or } t = \frac{100 \times 20}{32 \times 800} = \frac{5}{64} \text{ seconds.}$$

$$\text{From (ii), } 800 \times s = \frac{100}{64}(2010^2 - 1990^2) = \frac{100 \times 4000 \times 20}{64}.$$

$$s = \frac{100 \times 80000}{64 \times 800} = 156\tfrac{1}{4} \text{ ft.}$$

Ex. 5. Define work, energy, power, and horse-power, and explain the various units in which they are measured.

Prove that to transmit H horse-power by a shaft making N revolutions a minute, the turning moment must be 5,250 H/N foot pounds. (Inter. Sci., 1901.)

If T denote the twisting moment, then work done per minute $= T \times 2\pi N$; and as one horse-power is 33,000 ft. lbs. per minute, we obtain

$$T = \frac{H \times 33000}{2\pi N} = 5250 \text{ H/N.}$$

Ex. 6. Prove that the horse-power consumed in keeping a fly-wheel, weighing W tons, revolving N times per minute in bearings a feet diameter is

$$2240\pi a NW \sin\phi \div 33000,$$

where $\tan\phi$ denotes the coefficient of friction.

Prove that if left to itself the wheel will come to rest after

$$\frac{\pi k^2 N^2}{1800 g a \sin\phi} \text{ revolutions in } \frac{\pi k^2 N}{900 g a \sin\phi} \text{ minutes.}$$

(Inter. Sci., 1901.)

Eq. (1) may be written $\pi NaS \sin\phi$.

Also W tons $= 2240$W lbs.

$$\therefore \text{ H.P.} = \frac{2240\pi \times a \times NW \sin\phi}{33000}.$$

The kinetic energy of the wheel is given $\tfrac{1}{2}I\omega^2$, where I denotes the moment of inertia of the wheel, and ω its angular velocity in radians per second.

Also $I = Mk^2$, where M denotes the mass of the wheel, and k its radius of gyration.

$$\therefore \text{ kinetic energy of wheel} = \tfrac{1}{2} \times \frac{2240Wk^2}{g} \times \left(\frac{2\pi N}{60}\right)^2.$$

Also work absorbed per minute $= \pi Na \times 2240$W $\sin\phi$.

$$\therefore \text{ number of revolutions} = \frac{2240Wk^2 \times 4\pi^2N^2}{a \times 2g \times 3600 \times 2240W \sin\phi}$$

$$= \frac{\pi k^2 N^2}{1800 \times ga \sin\phi}.$$

Hence, as the average speed will be $\dfrac{N}{2}$, the time taken will be

$$\frac{\pi k^2 N^2}{900 ga \sin\phi}.$$

THE CODE AND HISTORY READERS.

NEW CONCENTRIC HISTORIES.

FASHIONS change even in Education Codes; perhaps more in Codes than in most things. There was a time when history, as a subject of school study, occupied quite a subordinate place in the Code, and could not, in consequence, receive that amount of attention in the schools which it deserved. Fortunately that bad old time is passed. A newer-fashioned Code recognises history as a subject of the highest importance, and history is to-day universally taught, not merely read, in class.

There are two main methods of history teaching—the *periodic* and the *concentric*. Each has its followers, each its merits. The *concentric*, having for its basis the underlying idea that the pupil should, in each year of his school-life, cover the whole course of English history in series of lessons progressively fuller in point of detail, and always suited to his stage of general advancement, has much to commend it. The notion of history as a record of progressing events in the nation's life is kept constantly before the pupil.

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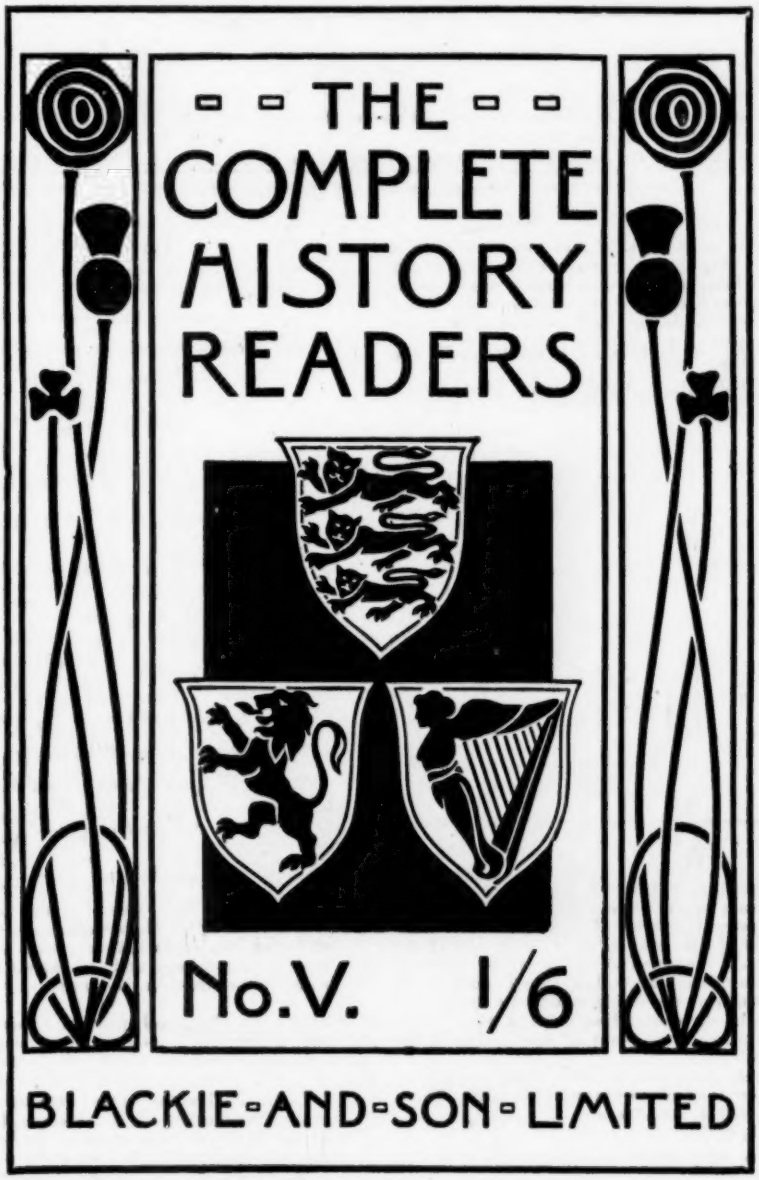

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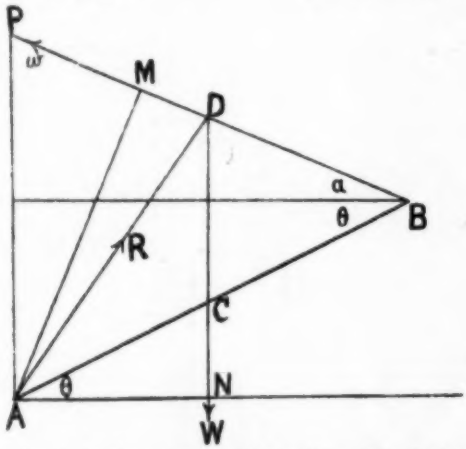
Bike.—A uniform beam of weight W can move freely in a vertical plane about a hinge at one end A; to the other end B a string is fastened, which passes over a smooth pulley vertically over A, and supports a weight w at the other end. Prove that the beam can rest inclined to the horizontal at an angle whose sine is $\frac{l}{2a}\left(1 - \frac{4w^2}{W^2}\right) + \frac{a}{2l}$, where a is the length of the beam and l is the height of the pulley above A. Find also the stress on the hinge. (B.A., London, 1896.)



Let P be the position of the pulley. Let θ be the inclination of the beam to the horizontal, and α that of the string when the system is at rest. Let the vertical through C, the middle point of AB, meet BP in D. Join AD. Then DA is the direction of the stress on the hinge; for the body being at rest under the action of three forces—namely, its weight W, the tension of the string w, and the reaction of the hinge at A—the direction of any one of these three forces must pass through the point of intersection of the directions of the other two.

From A draw AM perpendicular to BP, and let the vertical through C meet the horizontal through A in N. Then, taking moments about A, we have—

$$w \cdot AM = W \cdot AC \cos\theta.$$

But $AM = AB \sin ABM = a \sin(\theta + \alpha)$,

and $AC \cos\theta = \frac{a}{2}\cos\theta$.

Hence, $wa \sin(\theta + \alpha) = W\frac{a}{2}\cos\theta$.

$$\therefore 2w \sin(\theta + \alpha) = W \cos\theta \quad . \quad . \quad . \quad . \quad . \quad (i)$$

Now, from the triangle ABP we have—

$$AP : AB :: \sin ABP : \sin APB.$$

$$\therefore \frac{l}{a} = \frac{\sin(\theta + \alpha)}{\cos\alpha} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (ii)$$

From (ii) we have—

$$\sin(\theta + \alpha) = \frac{l}{a}\cos\alpha.$$

Substituting this value of $\sin(\theta + \alpha)$ in (i), we have—

$$2w\frac{l}{a}\cos\alpha = W\cos\theta.$$

$$\therefore \cos^2\alpha = \frac{a^2}{l^2}\frac{W^2}{4w^2}\cos^2\theta. \quad . \quad . \quad . \quad . \quad . \quad (iii)$$

But from (ii) we have also—

$$\frac{l}{a} = \sin\theta + \cos\theta\tan\alpha.$$

$$\therefore \cos^2\theta\tan^2\alpha = \frac{l^2}{a^2} - 2\frac{l}{a}\sin\theta + \sin^2\theta \quad . \quad . \quad (iv)$$

And from (iii) we have—

$$\frac{1}{\cos^2\alpha} = \frac{l^2}{a^2}\cdot\frac{4w^2}{W^2}\cdot\frac{1}{\cos^2\theta}.$$

$$\therefore \frac{1}{\cos^2\alpha} - 1 = \frac{l^2}{a^2}\cdot\frac{4w^2}{W^2}\cdot\frac{1}{\cos^2\theta} - 1.$$

$$\therefore \tan^2\alpha = \frac{l^2}{a^2}\cdot\frac{4w^2}{W^2}\cdot\frac{1}{\cos^2\theta} - 1.$$

$$\therefore \cos^2\theta\tan^2\alpha = \frac{l^2}{a^2}\cdot\frac{4w^2}{W^2} - \cos^2\theta \quad . \quad . \quad . \quad (v)$$

Equating R.H. sides of (iv) and (v), we have—

$$\frac{l^2}{a^2}\cdot\frac{4w^2}{W^2} - \cos^2\theta = \frac{l^2}{a^2} + \sin^2\theta - \frac{2l}{a}\sin\theta.$$

$$\therefore \frac{2l}{a}\sin\theta = \frac{l^2}{a^2}\left(1 - \frac{4w^2}{W^2}\right) + \sin^2\theta + \cos^2\theta.$$

$$\therefore \sin\theta = \frac{l}{2a}\left(1 - \frac{4w^2}{W^2}\right) + \frac{a}{2l}.$$

Having now the value of θ, the value of α may be obtained from (iii). We have then the two forces w, W, and $(90° + \alpha)$, the angle between their directions. Hence we have their resultant, and this, as we have shown above, is equal to the stress on the hinge.

Knight of the Duster.—If pairs of common tangents be drawn to three circles, and if one triad of common tangents be concurrent, the other triad will also be concurrent.

(Casey's *Sequel to the First Six Books of Euclid.*)

Let A, B, C be the centre of the three given circles. Denoting, for brevity, the given circles by A, B, and C, let H be the point of intersection of the pair of direct common tangents to A and B, K the point of intersection of the pair of direct common tangents to B and C, and L the point of intersection of the pair of direct common tangents to C and A, and let D, E, F be the intersections of the pairs of transverse common tangents taken in the same order.

Then, by Casey's *Sequel* (p. 84, Prop. 3), DFK, DEL, HEF, HLK are four straight lines. When F and E coincide, K will coincide with L; and when F and D coincide, H will coincide with L. Hence, when D, E, and F coincide, H, K, and L will coincide.

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Arum.—A jet of water issues from a circular pipe of ½-inch internal diameter at the rate of 15 gallons per minute. At what distance below the end of the pipe would the jet be capable of performing work with 1 horse-power if it were possible to use the whole of its energy?

Area of cross section of pipe $= (\frac{1}{2})^2 \times 0{\cdot}7854$ square inches.

Volume of water which issues per second $= \frac{1}{4}\frac{5}{0}$ gallons, or $\frac{277{\cdot}25}{4}$ cubic inches. Therefore velocity of jet at end of pipe

$$= \frac{277{\cdot}25}{4 \times \frac{1}{4} \times 0{\cdot}7854} = \frac{277{\cdot}25}{0{\cdot}7854} \text{ inches per second} = \frac{277{\cdot}25}{12 \times 0{\cdot}7854}$$

feet per second.

Weight of water which issues per minute = 150 lbs.

Therefore energy per minute at end of pipe $= \frac{1}{2} \cdot \frac{150}{32} \times \left(\frac{277{\cdot}25}{12 \times 0{\cdot}7854}\right)^2$ foot pounds.

Let h be the height of fall in feet. Then amount of energy per minute due to fall $= 150h$ foot pounds. Hence total energy per minute $= \frac{150}{64} \times \left(\frac{277{\cdot}25}{12 \times 0{\cdot}7854}\right)^2 + 150h$ foot pounds. But this is equal to 1 H.P., or 33,000 foot pounds per minute.

$$\therefore 150h + \frac{150}{64} \times \left(\frac{277{\cdot}25}{12 \times 0{\cdot}7854}\right)^2 = 33{,}000.$$

$$\therefore h = 220 - \left(\frac{277{\cdot}25}{96 \times 0{\cdot}7854}\right)^2 = 207 \text{ feet, nearly.}$$

Woolley.—Seven persons draw lots for the occupancy of the six seats in a first-class railway compartment. Find the chance (1) that two specified persons obtain opposite seats, (2) that they obtain adjacent seats on the same side.

(Hall and Knight's *Higher Algebra.*)

(1) The chance that either of the specified persons may obtain a seat is obviously $\frac{6}{7}$. Further, the chance that, having obtained a seat, he may have the other specified person opposite to him is $\frac{1}{5}$. Hence the chance that the two specified persons may obtain opposite seats is $\frac{1}{5}$ of $\frac{6}{7}$, or $\frac{6}{35}$.

(2) The number of ways of placing either of the specified persons is 7. With each of these the other specified person may be placed in 6 ways. Hence there are 7×6 or 42 ways of placing the two specified persons. Again, the number of ways in which the two persons may occupy adjacent seats on the same side is 4 for one side of the compartment and 4 for the other side. Hence there are 8 ways in which the two specified persons may occupy adjacent seats on the same side.

Therefore the chance that two specified persons may secure adjacent seats on the same side is $\frac{8}{42}$—that is, $\frac{4}{21}$.

Girt.—Prove that

$$\sin^2 10^\circ + \cos^2 20^\circ - \sin 10^\circ \cos 20^\circ = \tfrac{3}{4}$$
$$= \sin^2 10^\circ + \cos^2 40^\circ + \sin 10^\circ \cos 40^\circ.$$

(Math. Tripos, 1881.)

$$\sin^2 10^\circ + \cos^2 20^\circ - \sin 10^\circ \cos 20^\circ$$
$$= \cos^2 80^\circ + \cos^2 20^\circ - \cos 80^\circ \cos 20^\circ$$
$$= \cos 80^\circ (\cos 80^\circ - \cos 20^\circ) + \cos^2 20^\circ$$
$$= -\cos 80^\circ 2 \sin 50^\circ \sin 30^\circ + \cos^2 20^\circ$$
$$= -\cos 80^\circ \cos 40^\circ + \cos^2 20^\circ$$
$$= -\tfrac{1}{2}(\cos 120^\circ + \cos 40^\circ) + \cos^2 20^\circ$$
$$= \tfrac{1}{4} - \tfrac{1}{2}(\cos^2 20^\circ - \sin^2 20^\circ) + \cos^2 20^\circ$$
$$= \tfrac{1}{4} + \tfrac{1}{2}(\sin^2 20^\circ + \cos^2 20^\circ) = \tfrac{3}{4}.$$

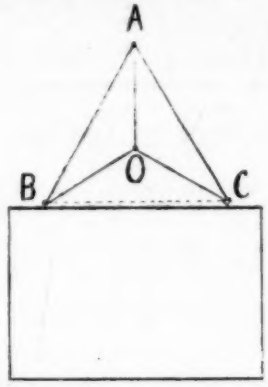
Again, $\sin^2 10^\circ + \cos^2 40^\circ + \sin 10^\circ \cos 40^\circ$
$$= \cos^2 80^\circ + \cos^2 40^\circ + \cos 80^\circ \cos 40^\circ$$
$$= \cos 80^\circ (\cos 80^\circ + \cos 40^\circ) + \cos^2 40^\circ$$
$$= \cos 80^\circ 2 \cos 60^\circ \cos 20^\circ + \cos^2 40^\circ$$
$$= \cos 80^\circ \cos 20^\circ + \cos^2 40^\circ$$
$$= \tfrac{1}{2}(\cos 100^\circ + \cos 60^\circ) + \cos^2 40^\circ$$
$$= \tfrac{1}{4} - \tfrac{1}{2} \cos 80^\circ + \cos^2 40^\circ$$
$$= \tfrac{1}{4} + \tfrac{1}{2}(\cos^2 40 + \sin^2 40^\circ) = \tfrac{3}{4}.$$

Xmas.—A force equal to the weight of 4 ounces is required to pull a small ball of soft iron from contact with one of the poles of a magnet A, and a force equal to the weight of 9 ounces to pull the same ball off one of the poles of a second magnet B. Determine the relative strength of the poles of the magnets A and B.

The carrying power of a magnet being proportional to the square of the strength of the pole, if a denotes the strength of a pole of the magnet A, and b the strength of a pole of the magnet B, we have $a^2 : b^2 :: 4 : 9$.

Hence $a : b :: 2 : 3$.

Equal Tension.—A picture is suspended from a nail A by strings ABOCA and OA. The former passes through two smooth rings at B and C, so placed that ABC is an equilateral triangle; and at O, the centre of ABC, it is knotted to the string OA, which is also suspended from A. Given the weight W of the picture, determine the tensions of the strings.



The weight W may be replaced by two equal forces $\frac{W}{2}$, $\frac{W}{2}$ acting vertically downwards at B and C respectively.

Taking the point C, we find this is at rest under three forces—namely, the weight $\frac{W}{2}$ and the tensions along CA and CO. The two latter forces are obviously equal, since C is a smooth ring. Denote the tension by T. Then resolving vertically and horizontally, we have—

$$\text{T} \cos 30^\circ + \text{T} \cos 60^\circ = \frac{\text{W}}{2}.$$
$$\therefore \text{T}(\cos 30^\circ + \cos 60^\circ) = \frac{\text{W}}{2}.$$
$$\therefore \text{T}\left(\frac{\sqrt{3}}{2} + \frac{1}{2}\right) = \frac{\text{W}}{2}.$$
$$\text{Hence T} = \frac{\text{W}}{\sqrt{3}+1}.$$
$$\therefore \text{T} = \frac{\text{W}}{2}(\sqrt{3} - 1).$$

Again, the point O is in equilibrium under the action of the three tensions along OB, OC, and OA respectively. But the directions of these, taken in pairs, make angles of 120°. Therefore these tensions are equal to one another. Hence the tension in each string is $\frac{\text{W}}{2}(\sqrt{3} - 1)$.

Fern.—Two vessels contain the same amount of mixtures of two liquids; in one vessel the liquids are mixed in the proportion of 2 to 3. In what proportion are they mixed in the other, if, when the contents of one vessel are poured into the other, the liquids are in the ratio of 3 to 4?

(Coll. of Precep., Certif. Exam., Algebra (1st Class), 1894.)

Suppose we have in the first vessel a mixture of 2 volumes of a liquid A with 3 volumes of a liquid B, and that the contents of the second vessel consist of a mixture of m volumes of A with n volumes of B, the unit volume being the same in both cases. Then, since by the question the same volume is contained in either vessel, we must have—

$$m + n = 5. \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

Further, the final mixture will consist of $(m + 2)$ volumes of A and $(n + 3)$ volumes of B. Hence, by the question, we have—

$$\frac{m+2}{n+3} = \frac{3}{4}. \quad \therefore 4m - 3n = 1.$$

But, from (1), $3m + 3n = 15$.

$$\text{Hence } m = \frac{16}{7}, \text{ and } n = \frac{19}{7}.$$
$$\therefore m : n :: 16 : 19.$$

Hence in the second vessel the liquids are mixed in the proportion of 16 to 19.

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Rex.—Plot the graph $y = \frac{x^2 - 4x + 6}{x - 2}$, putting in turning points and asymptotes. From your curve find whether the roots of the following equations are real or impossible—

(i) $\frac{x^2 - 4x + 6}{x - 2} = 3\frac{1}{3}$. (ii) $\frac{x^2 - 4x + 6}{x - 2} = 1\frac{1}{3}$.

Following the method and notation used in Chrystal's *Introduction to Algebra*, chap. xxv., we write the equation $y = \frac{x^2 - 4x + 6}{x - 2}$ in the form $x^2 - (y + 4)x + 2y + 6 = 0$.

Solving the last equation for x, we find the discriminant $\Delta \equiv (y + 4)^2 - 4(2y + 6) \equiv y^2 - 8 \equiv (y - 2\sqrt{2})(y + 2\sqrt{2})$.

Hence we see that Δ vanishes when $y = 2\sqrt{2}$, and becomes negative if y is a little less than $2\sqrt{2}$. Therefore $y = 2\sqrt{2}$ is a minimum turning value. Again, Δ vanishes when $y = -2\sqrt{2}$, and becomes negative if y is (algebraically) a little greater than $-2\sqrt{2}$. Hence $y = -2\sqrt{2}$ is a maximum turning value. The values of x corresponding to these values of y are easily seen to be $\frac{2\sqrt{2} + 4}{2}$ and $\frac{-2\sqrt{2} + 4}{2}$. The maximum turning point is therefore $(2 - \sqrt{2}, -2\sqrt{2})$, and the minimum turning point is $(2 + \sqrt{2}, 2\sqrt{2})$.

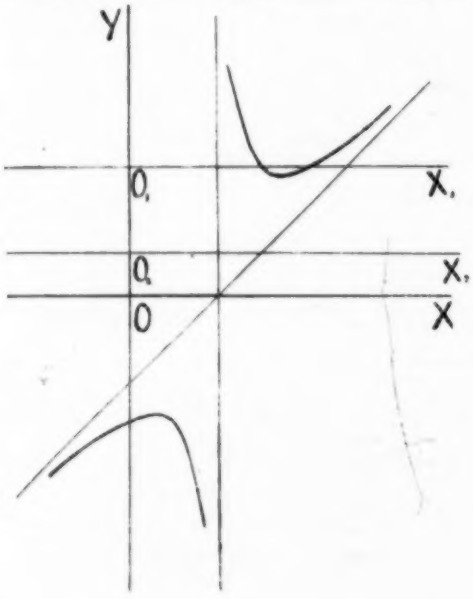
Again, the R.H. side of the equation $y = \frac{x^2 - 4x + 6}{x - 2}$ may be written in the form $\frac{(x - 2)^2 + 2}{x - 2} \equiv x - 2 + \frac{2}{x - 2}$.

From this the corresponding values of x and y shown in the following table are readily deduced.

x	y
$-\infty$	$-\infty$
-2	-4.5
-1	$-3.6\cdot$
0	-3
1	-3
$2 - 0$	$-\infty$
$2 + 0$	$+\infty$
3	3
4	3
5	$3.6\cdot$
6	4.5
$+\infty$	$+\infty$

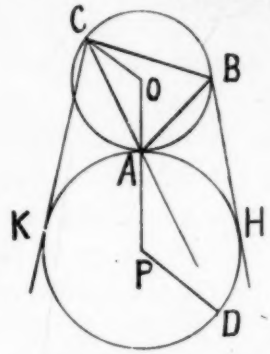
From this it is obvious that the ordinate $x = 2$ is one asymptote, and the line through the point (2, 0) equally inclined to the axes is another.

Plotting these values, as well as the turning points determined above, we obtain the graph shown in the figure.



If, on the axis of y, we take O_1 distant $3\frac{1}{3}$ linear units from O in the positive direction, and O_2 distant $1\frac{1}{3}$ from O, and draw O_1X_1, O_2X_2 parallel to OX, we find that O_1X_1 cuts the curve in two points, while O_2X_2 does not intersect it. Hence the roots of $\frac{x^2 - 2x + 6}{x - 2} = 3\frac{1}{3}$ are real, but those of the equation $\frac{x^2 - 2x + 6}{x - 2} = 1\frac{1}{3}$ are impossible.

Carrett.—A circle is drawn to touch the circumscribed circle of a triangle ABC at the point A. Prove that the tangents drawn to it from the points B, C are in the ratio of the sides BA, CA. (Cambridge Junior, 1899.)



Let ABC be a triangle, and let the circle KAH be drawn touching the circle about ABC in the point A. Draw BH, CK tangents to the circle KAH, and let H, K be the points of contact. Produce CA to meet the circle KAH again at D. Let O, P be the centres of the circles ABC, KAH. Then the straight line joining OP passes through the point of contact A. Join OC, PD.

Because DAC cuts the circle KAH, and CK meets it, therefore $DC \cdot CA = CK^2$.

$\therefore CK^2 : CA^2 :: DC \cdot CA : CA^2$.

$\therefore CK^2 : CA^2 :: DC : CA$.

Again, $\angle PDA = \angle DAP = \angle OAC = \angle OCA$. Therefore CO is parallel to DP.

Hence $PO : OA :: DC : CA$ (Euclid VI. 2).

$\therefore CK^2 : CA^2 :: PO : OA$.

Similarly we may show that

$BH^2 : AB^2 :: PO : OA$.

Hence $CK^2 : CA^2 :: BH^2 : AB^2$.

$\therefore BH^2 : CK^2 :: AB^2 : AC^2$.

$\therefore BH : CK :: AB : AC$.

H.C.H.—Find sin A from the equation

$$\tan A + \sec A = a.$$

$$\tan A = \frac{\sin A}{\cos A}, \quad \sec A = \frac{1}{\cos A}.$$

$$\therefore \frac{\sin A + 1}{\cos A} = a.$$

$$\therefore \frac{(\sin A + 1)^2}{\cos^2 A} = a^2.$$

$$\therefore \frac{(\sin A + 1)^2}{1 - \sin^2 A} = a^2.$$

$$\therefore (\sin A + 1)^2 = a^2(1 - \sin^2 A).$$

$$\therefore \sin^2 A + 2 \sin A + 1 = a^2 - a^2 \sin^2 A.$$

$$\therefore (a^2 + 1) \sin^2 A + 2 \sin A - (a^2 - 1) = 0.$$

$$\therefore \sin A = \frac{-1 \pm \sqrt{\{1 + (a^2 + 1)(a^2 - 1)\}}}{a^2 + 1}.$$

$$\therefore \sin A = \frac{-1 \pm \sqrt{(1 + a^4 - 1)}}{a^2 + 1}.$$

$$\therefore \sin A = \frac{-1 \pm a^2}{a^2 + 1}.$$

Hence $\sin A = \frac{a^2 - 1}{a^2 + 1}$, or -1.

The latter value does not satisfy the given equation. Therefore

$$\sin A = \frac{a^2 - 1}{a^2 + 1}.$$

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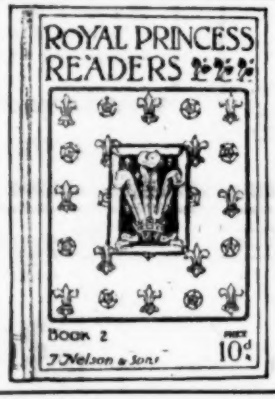

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